

EOS, Transactions, American Geophysical Union

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Vol. 64, No. 34, Pages 513-520

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EARTHQUAKES, PLATE SUBDUCTION, AND STRESS

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L. B. Bouse and B. H. Jacob Liemont-Boherty
Gaological Cheerwiery of Columbia University,
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Call for Papers (including abstract specifications) was published in Eos. June 28 and July 26 For more information, wille,

Erosion of U.S. **Shorelines**

S. Kimball May, Robert Dolan, and Bruce P.

Hayden Department of Environmental Sciences, University of Virginia, Charlottesville, Virginia 22903

We have assembled data on the rate of change of the U.S. shorelines, including those of the Great Lakes. Obtained from geologists and engi-neers our data have covers 1680 sites. The maneers, our data base covers 1080 sites. The na-tional sverage (unweighted) shureline erosion rate is 0.40 m/yr. Along the Atlantic coast the merge rate of recession is 0.8 m/yr, the Culf-coast is 1.8 m/yr; and the Pacific coast rate, including Alaska, is 0.005 m/yr. Statistics for Delaware Bay, Cherapeuke Bay, and the Great Like are also communiced.

Introduction

The River and Harbur Act of 1968 issued mandate to the U.S. Army Corps of Engineers to compile an inventory of the nation' rosslines, including the Grent Lakes. The final summary, "A Report on the National Shoreline Study," indicates that of the nation's 84,240 miles of coastline, 20,500 miles could be categorized as "seriously eroding" at the time the study was initiated [U.S. Army Corps of Engineers (USACE), 1971]. Nine renal reports provide specific information

and proposals for corrective measures.
In evaluating the National Shoreline Study. the General Accounting Office determined that lack of adequate funding and personnel and inconsistencies in methadology and assemment criteria prevented the study from salidying any but the broadest requirements of the mandate [U.S. General Accounting Office. 1975). However, to date, the National Shoreline Study has remained the only comprehensite assersment of coastal conditions on a naionwide scale.

In 1979 we reported on rates of shoreline erosion of the misl-Atlantic Osast from New Jettey to North Carolina [Dolan et al., 1979]. Since then, under sponsorship of the U.S. Geological Survey, we have assembled data on shoreline changes for the remainder of the United States, including Chesapeake Bay, the Great Lakes, and Alaska. The informaton is designed for presentation us a series of US. Geological Survey maps thafted at a 1-2,000,000 scale, as a 1:7,500,000 scale map in a National Atlas format. The assembled data bank of shoteline rates of change is actenible in a computerized Coastal Erusion Information System (CEIS) at the University of Virginia. We are currently analyzing coasial haurds and are developing statistical evaluaions of vulnerability to constal processes. These data are included in CEIS and are detaled in a separate map series. We will discos coastal hazards in a subsequent report. lathis paper we present a summury of the differences in crusion rates fur various gengraphic regions of the United States.

Mechanisms for Shoreline Change

Shorelines recede when the forecs of eroson exceed the amount of sediment supplied to the coast. The greater the deficiency of and, or the higher the wave energy, the more rapid the rate of erusinn. Any of three faors (energy, sediment supply, ur sea level)
can vary through time and change the bal-

Sediment Transport

Three principal classes of sand movement are responsible for most changes occurring to beaches and barrier islands: (1) universely along the shore when waves approaching the toast at an angle set up sediment transporting processes called longshore currents; (2)
mayement across the shore during periods of
high seasons. high waves and tides when water levels may be devated to the point that the beach is oremashed; and (3) movement of sediment by wind action.

All beaches and barrier islands respond to these dominant processes; there are, howevet, significant regional differences [Fisher, 1988; Godfrey et ol., 1979]. It the northeast, for example, overwash occurs less frequently, and large dunes and cliffs have formed from ediment eroded from glacial deposits, white along the mid-Atlantic coast, where dde ranges are lower, overwash is a more common process.

flutricanes are responsible for eventue

mid-latitudes. Each year, between 30 and 40 such storms generate potentially damaging surges and waves. The Lincoln's Birthday storm of Fehrmary 12, 1973, for example, caused severe beach erosion along the coast from Long Island, New York, to Miami, Florida, and the Ash Wednesday storm of March 7, 1962, produced waves over 10 m high, damaging millions of dollars of property along the mid-Atlantic coast [Coopernan and Rusendal, 1962]. Similarly, a series of extratropical storms in December 1982 and January 1983 caused extensive damage to the heaches and shoreline developments along the California coast

Water Levels and Sea Level Fluctuations

Gradual variations in water level oreur through titles, storm surge, and long term sea level fluctuations. Tidal action alone has little effect on long-term shoreline change, but when storm surge and high waves are super-imposed, elevation and depression of the water level becomes an important agent in seiliment trausport.

As a result of the moun's elliptical orbit. there is a minimal distance between the moon and earth once during each revolution. When this coincides with sysygy, higher tides, called perigean spring tides, are generated. Wood [1976] shows a strong coincidence of cala-strophic storms and perigean spring titles. One hundred of the most severe coasial storms between 1635 and 1976, including the Ash Wednesday storm of 1962, occurred at

the time of perigean spring tides.
During the Wisconsin glacial period, approximately 15,000 B.P., sea level was about 120 in lower than it is today, and the shorelines of the Atlantic and Gulf coasts were 60-150 km seaward of their present position. Sen level reached within several meters of the present level about 5000 yr ago and has remained fairly stable since then. However, a slow rise over the past 2000 years has cesulted in recession of shorelines and enlargement of coastal bays and sounds. Over the past 100 yr, the rise has been rapid, totaling slightly more than 30 cm (*Hicks and Comby*, 1975).

Measurement of Shoreline Change

The national shoreline erosion maps are based on data acquired by a variety of methoils ranging from precise engineering surveys to general appraisals of old photographs. The advantages and disadvantages of these methrals are listed below [Dolan et al., 1978]:

Repeated Ground Surveys

Cost: Data acquisition is expensive because uf the large number of man hours required. Accuracy: Resolution on the order of 0.01 m grunted distance. Advantages: (1) Measure-ments are direct. (2) Individual measurements may be updated at relatively moderate cost. (3) Methadolugy is commonly understood by the public. (4) Measurement is commensurate with local property records. Disadvantages: (1) Historical timeline of data usually not available. (2) Accuracy of measurement greatly exceeds the resolution of shoreline definition. (3) Along-the-coast density is poor. (4) Systematic updating of extensive coastal reacties is expensive and time consuming.

Historic maps and charls

Cost: Existing maps and charts are generalerading new maps are high. Accuracy: Estimates of map accuracy are often unavailable, but can be estimated in tens of meters. Advantages: Maps and charts from the mid-1800's are available for much of the United States, thus providing an unusually long time frame for determination of shoreline changes. Disadvantages: (1) Irregular availability. (2) Unstable map bases. (3) Low accuracy and resolution. (4) No correction for sea state or tide level.

Aerial Photography

Cost: Given the along the coast density of available data, the cost is rated as low. Acci-racy: Resolution of data varies with scale of otography and methods employed. Errors in the range of 2.5 m ground distance are typical [Dolon et al., 1980]. Advantages: (1) Along the coast resolution is high. (2) Historical data for the last 40 years are usually available. able. (3) Data are time specific. (4) Shoreline definition is within the resolution error of systems being analyzed, (5) Repeated coverage is inexpensive if extensive coastal areas age is inexpensive if extensive coastal areas.

The system is designed in a tutorial mode are included. (6) Frequent coverage in time is for easy user access. Once logged into the sys-

Data Collection and Analysis

The national shoreline change that hank was created from the best and most comprehensive of existing information sets contributed by coastal scientists nationwide. Initially, the approach was to uhtain maximum coverage by using the most readily available data sets. Preference was given to studies with a wide range, both tempural and spatial, and which were already available in graphic form. Once the broad reaches were covered, higher resolution, site-specific information was introduced. Appropriate district and division uffices of the U.S. Army Corps of Engineers were contacted for information. Because uf dieir involvement with the National Shurcline Study, the Corps was able to provide up-todate lists of coastal scientists and other contacts who could provide thata. Requests for data were also made to state offices with responsibility for coastal affairs, sea grant offices, and university departments.

Most contacts provided reports, data sets, and/or further contacts. It was quickly established that the mid-Atlantic, southeast, Gulf, and Great Lakes areas are data rich. In contrast, the Pacific, Alaskan, and northeast coasts have not been succeed as extensively or quantitatively. These areas lack information because shoreling change is episodic and/ or catastrophic so a continuous day-to-day threat is not perceived by the coastal communnities, ur the population densities are so low that continuous shoreline monitoring is not a high priority.

As the data were collected, they were toins ferred onto 1:2,000,000 scale Mylar tomsparencies. In many instances, two or mure information sets were available for a given reach. In such cases, time span and currency of in-formation were considered. More recent studies were chosen over older ones because they are generally made with knuwledge of preceding work and reflect the earlier information. Where a choice of length of historical record appeared, long-team rates were favored over short term for two reasons: More of the data sets present average rates based on the study of charts drafted in the late 19th century onto which successive series of maps and aerial imagery were superimposed, so, using the longest period of cecord made the majority of studies similar in terms of the ini-tial baseline, and the effects of single catastophic events were like ced.

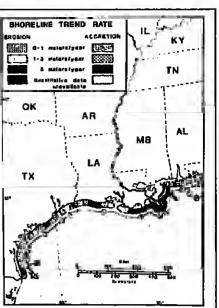
In aceas where detailed information was not available for periods of over 100 yr, the measurement base or type became a criterion for inclusion. Since the development of mapping-quality aerial photography in the 1930's, the quantitication of short-line changes over large ceaches of the coast has become possible. The period of record is generally 40-50 yr, and the studies or data are all current, so die effects of recent engineering structures are usually included.

The rate of shoreline change, length, and final year of study and measurement base are indicated on our 1:2,000,000 scale maps for each reach. At this scale, 2 km ground distance is I mm map distance. To record the maximum amount of information, all data were processed to conform with a minimum mapping unit of 5 inm. Where barrier islands are present, islands shorter than the minimum mapping unit are kept as a single unit. We attempted to group similar recession rates together but not to average rates for islands with significantly higher or lower rates on adjacent Islands.

After all the data sets were recorded on the Mylar maps, the information was processed to create a set of maps, also at a scale of 1:2,000,000, on which rate classes are depleted in an easy to read manner (Figure 1). Our objective was to have broad enough classes to include significant variation about the low resolution means yet narrow enough to do justice to those high resolution studies with low variances. The errors involved in obtaining average rates of change from limited numbers of profiles is somewhat diminished by the use of rate classes. The broad classes will bracket the true rate for a given reach in an acceptable graphic form. For more de-talled information, we will refer the users to the original data sources.

Coastal Erosion. **Information System**

All Information gadiered for the man series is contained in an easy-access computer-lized information system [May et al., 1982]. CEIS is designed to provide the user with original rate of change data, primary sources, statistical summaries, and notes regarding special interest features for any given reach of coast. The information is stored in grid cells, which are 3 into latitude or longitude on a side. Each cell is filed and identified by the ladtude and longitude of its northwest corner.



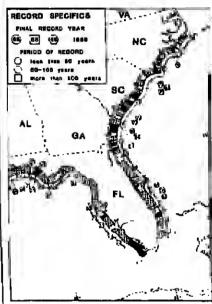


Fig. 1. Example of the National Erosion Map draft: Golf and Atlantic coasts.





Fig. 2. Site-apecific CE1S query

Delaware bays. The only information that the user must know prior to entering the system is the latitude and longlinde of the area of in-terest. Rate-of-change information is printed out for each 3 min grid cell. Statistical summaries and data sources are liated for the reach (Figure 2).

Migration of the U.S. **Shorelines: Summary**

We used GEIS to generate statistical summaries of rate of-change data for each constains state and for reaches with almiin geology and shoreline geomorphology (Tables 1 and 2). In Table 1, the mean rate of change for

each coastal state, within state standard deviations of these rates, and the extreme range of rates are listed. Along the Atlantic coast, the average erosion rate is about 0.8 mlyr (recession), with thre Virginia barrier islands, Maryland; and New Jersey having the most pronounced erosion rates, up to 4.1 m/yr. The rapid erosion of Virginia's shoreline is largely confined to the Virginia barrier is-

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TABLE 1a. Rate of Change Statistics for States and Regions: Oceanic Coastlines

Region	ž, π/yr*	σ	Total Range*		Nt	
Atlantic Coast	-0.8	3.2	25.5	-24.6	510	
Maine	-0.4	0,6	1.9	-0.5	16	
New Hampshire	~0.5		-0.5	-0.5	4	
Massachuae us	-0.9	1.9	4.5	-4.5	48	
Rhode Island	-0.5	0.1	-0.3	-0.7	17	
New Yurk	0.1	3.2	18.8	-2.2	42	
New Jersey	-1.0	5. 4	25.5	-15.0	39	
Dclaware	0.1	2.4	5.0	-2.3	7	
Maryland	-1.5	3.0	1.3	-8.8	9	
Virginia	-4.2	5.5	0.9	-24.6	34	
Nurth Carolina	-0.6	2.1	9.4	÷6.0	101	
South Carolina	-2.0	3. g	5.9	-17.7	57	
Georgia	0.7	2.8	5.0	-4.0	31	
Florida	-0.1	l.2	5.0	-2.9	105	
Gulf of Mexico	-1.8	2.7	8.8	-15.3	358	
Florida	-0.4	1.6	g.g	-4.5	H	
Alabama	-1.1	0.6	-0.8	-3.1	16	
Mississippi	~0.6	2,0	0.6	-6.4	12	
Louisiana	-4.2	3.3	3.4	-15.3	106	
Texas	~1.2	1.4	0.8	-5.0	106	
Pacific Coast	-0.0	1.5	10.0	-5.0	305	
California	~0.1	1.3	10.0	-4.2	164	
Otegon	-0.1	1.4	5.0	-5.0	86	
Washington	0.5	2.2	5.0	-3.9	46	
Alaska	-2.4	2.0	2.9	-6.0	69	

^{*}The negative values indicate erosion; the positive values indicate accretion. †Total number of 3-min guid cells over which statistics are calculated.

TABLE 16. Rate of Change Statistics for States and Regions: Bays and Lakes

Region	x, in/yr•	σ	Total Range*		N †
Delaware Bay					
New Jersey	-1.9	1.3	0.3	-3.0	15
Delaw.cre	- 1.3	2.1	5.0	-3.0	is
Chesapeake Bay	-0.7	0.7	1.5	-4.2	130
Western shore	-0.7	0.5	1.5	- i.9	67
Maryland	-0.7	0.3	-0.1	-1.3	35
Virginia	~0.g	0.7	1.5	-1.9	32
Eastern shore	-0.7	0.8	0.1	-4.2	69
Maryland	-0.8	0.9	-0.3	-4.2	47
Virginia	-0.5	0.4	0.1	-1.2	20
Great Lakes	-0.7	0.5	0.6	-2.7	327
Lake Erie	-0.7	0.6	-0.2	-2.4	98
Ohio	-0.6	0.6	-0.2	-2.2	68
Pennsylvania	-0.3	0.1	-0.2	-0.4	14
New York	-1.4	0.6	-0.5	-2.4	20
Lake Ontario	-0.5	0.2	-0.2	-1.2	
Lake Huron	-0.4	0.3	-0.3	-1.3	58
Lake Michigan	-0.6	8.0	0.6	~9.9	28
Western shore	-0.6	0.4	0.6	-1.5	184
Eastern shore	-0.7	0.9	0.3	-9.9	62
Wisconsin	-0.7	0.3	-0.3	-9.5 -1.5	122
llimois	-0.2	0.4	0.6	-0.9	46
Indiana	-0.4	0.5	-0.3		16
Alichigan	- 0.7	0.9	-0.3	-0.9	12
Lake Superior	-1.3	0.7	-0.3	-9.9	110
Minnesota	-0.8	0.4	-0.3	-2.7	35
Wisconsin	1.g	0.6	-0.9	-1.5 -2.7	16 19

Negative values indicate erosion; the positive values indicate accretion. †Total number of 3-min grid cells over which the statistics are calculated.

TARIF 9 Page of Change Statistics Co. C.

TABLE	2. Rate of Chang	Rate of Change Sististics for Coastal Landform Types					
Region	₽, m/yr*	σ	Total Range*		Nt		
Mud flats							
Fla.	-0.3	0.9	1.5	-1.5			
LaTexas	-2.1	2.2	3.4	-1.5 -8.1	9		
All Gulf	-1.9	2.2	3.4		84		
Rock shorelinea			3.7	-g.	93		
Atlantic	1.0	1.2	1.9				
Pacific	-0.5		-0.5	-4.5	36		
Pocket beachea		_	-0.5	-0.5	7		
Adantic	-0.5	_	-0.5				
Pacific	-0.2	1.1	-0.5	-0.5	9		
Sand beaches	~		5.0	-1.1	144		
Maine-Mass.	-0.7	0.5	^-				
MassN.J.	-1.3	1.3	-0.5	-2.5	17		
Atlantic	-1.0	1.0	2.0	-4.5	22		
Oulf	-0.4		2.0	-4.5	39		
Pacific	-0.3	1.6	8.g	-4.5	121		
Sand beaches with	0.5	1.0	. 0.7	-4.1	19		
rock headland	0.3						
Deltas	-2.5	1.9	10.0	-5.0	134		
Barrier Islands	-2,3	3.5	8.g	~15.3	155		
LaTexas	-0.g						
FlaLa.		1.2	0.g	~3,5	76		
Gulf	-0.5	1.7	8.g	-4.5	82		
Maine-N.Y.	-0.6	1.5	g.g	-4,3	158		
N.YN.C.	0.3	2.6	4.5	-1.5	12		
N.CFla,	-1.5	4.5	25.5	-24.6	153		
Atlantle	-0.4	2.6	9.4	-17.7	256		
Virtuic	-0.g	3.4	25,5	~24.6	471		

^{*}Negative values indicate erosion; the positive values indicate accretion †Total number of 3-min grid eells over which the statisties are calculated

average. Erosion rates along Chesapenke Bay's shoreline are of the same order as the Atlantic coast average. Overall, the Atlantic coast can be characterized as a receding system, with 403 of the 510 grid edls (79%) showing some measure of erosion.

The Gulf coast states have the distinction of having the most tapid average erosion rates (1.8 m/yr) on n national scale, almost 5 times the average for our total 1689 sites, Within the Gulf coast region, the deltaic coast of Luuislana is by far the most dynamic (4.2 in/yr erosion). Like the Adantic coast, the Gulf region can be described as eroding. However, the percentage of receding areas is somewhat less (63%). This is due, in part, to the large area covered by the active Mississippi della system and, in part, to extensive regions in southern Florida that are essentially

In general, the Great Lakes shorelines are receding at rates (0.8 m/yr) commensurate

with the Atlantic coast. The highest erosion rates are found along the shorelines of Lake Superior (1.3 m/yr) and Lake Erie (0.7 m/yr). goth these lakes have long east-west dimen-sions and, thus, large fetches during die eastward passage of storms. The Pacific coast, including Alaska, has the lowest erosion rates (0.005 m/yr), as indicated by the available sources, as well as the lowest overall percent-

age of eroding areas (less than 30%). While erosion rates for the hays and lakes are of the same order as for ocean coasts, the along-the-coast variability is much lower. For example, Chesapeake Bay (0.7 m/yr recession) and the Atlantic coast (0.8 m/yr recession) have about the same mean rate of change, but die along the coast variability for the Adantic coast (±3.2 m/yr) is an order of magnitude higher than that of Ghesapeake Bay (±0.7 m/yr).

Paul F. May and Neal Grandy provided in-valuable assistance with the design and graphic display of the National Erosion Map. When the national erosion rates are: This work is supported by a U.S. Geological Survey pitrchase order (41965) and by the grouped on a basis of the shorezone geology.

Forum Methane and Seismicity:

A Reply In a recent Forum article in Em t"Abriliane in Association With Scismic Activity." June 14, 1983, p. 41(t), R. S. Oremland presents observations which he claims contradict the deep methane gas hypothesis. His principal case rests on observations of one M 5.7 earthounke near the volcanic area of Mammonth Lakes, California. which did not result in any increase in methane content of gases in four local

In our published discussions of the deep gas hypothesis [Gold and Soter, 1980. 1982], we proposed (1) that outgassing from manule depths is an ongoing process both in volcanic and nonvolcanic regions; (2) that the gases CO2 and CH3 are the principal carriers of the surface excess carbon; (3) that chemical equilibrium between CO2 and CH4 in the presence of hot or liquid ruck is strongly shifted powards CO2, especially in the low pressure domain, and that therefore active volcunic or high heat flow regions would be less likely to exhibit CH4; and (4) that faultlines, particularly those which are seismically active, are locations where outgassing in cool regions can be sampled. The evidence there is that flames from the ground are often seen in association with major earthquakes. (Just as in many mul volcano eruptions, ignition of combustible gases can be attributed to electrostatic ef-fects. Methane is also observed in many of the major crustal rifts, together with helium having the high 'He to 'lle ratio indicative of deep origin [Lupton, 1983].

Based on this type of evidence we concluded that methane was very likely the combustible component that escaped somerimes during earthquakes, although hydrogen is also a good possibility. Of course there are great regional variations in the type of gas found in deep wells and we would expect this to be reflected in regional variations in the gases that escape during earthquakes. The observation of one moderate earthquake with no associated increase in the methane outgassing it four seeps can hardly he regarded as a contradiction to the deep gas hypothesis. It also does not add to nr subtract from the evidence of flames in the Owens Valley earthquake of 1872. All that can be said is that no combustible gases were observed in the Mammouth Lakes earthquake of 1978, just as no combustible gases have been observed in many other earthquakes. Combustilile gases have, however, been observed in a large number of other cases, particularly during major earthquakes in which landing extended to

the surface. The low levels of methane found in most rolcanic emissions may be due either to its absence in the source gases entering the magma chamber, or to its oxidation there, which must certainly be expected. At great depths, methane tentls to be pressure-stabilized despite the high temperatures. But most of the deep source

the resulting patterns are, for the most part, as one would expect (Table 2). We used the

each rock type into the geographic regions. Coasts with fine-grained sediments, deltas,

and mudflats have the highest mean erosion

rates (2.0 m/yr reression), while most sandy

barrier islands. The Gulf coast barrier islands

are receding at a mean rate of 1.6 m/yr, with

some islands having erosion rates as high as

15.9 m/yr. The Atlantic coast mudflats have

the highest mean erosion rates (2.0 m/yr re-

cession), while most sandy beaches and barri-

er islands are eroding at lower rates (0.8 m/

yr). The rate of Atlantic coast barrier island

recession over the last 2000 yr varied as the

rate of the sea level rise changed, the supply of sedlment waned, and the inner shelf slope

evolved. Some of the eroded material has

been lost into large offshore sediment sinks,

such as Diamond Shoals off Cape Hatteras.

barrier island acdiment budget and has con-tributed to spit growth, inlet filling, dune

All the second with the second

building, and storm overwash deposits.

Acknowledgments |

Much of It, however, has remained within the

beaches and barrier islands are eroding at

bound areas are accreting at 1.0 mlyr.

methans which lands its way into the liqnid rock of a volcano will probably be on diverging CCOs as in comes into contact at teduced pressures with the abundant oxygen available in the hot nagma. Nevertheless, methane has been detend

in munetous volcanic emissions, sometimes even at combustible concentrations Chemland claims that such mineral-caplyzed exidation of Cllb to CO2 is not supported by experimental evidence and he cites Surkett and Chang [1979] to that eflect. However, those authors demonstrate merely the absence of isotopic and chemcal equilibrium between CIIa and CO2 heated to 500°C for several days. Giggn-bach [1982] has since shown theoretically that equilibration under such conditions is expected to be negligible in times less than a year, but should go to completion in a lew hundered years. Certainly at the bigh temperatures (and low pressures) of s tolcanic vent the equilibration will be very

The statement that organic debrican account for some of the methane in tokenoes does not contradict our hypothesis that some volcanic methane has a deeper origin, as Oremland seems to suggest Lastly, Oremland claims that "observations of isotopically heavy methane...in association with phones of 'He emanating geothermal regions. . .does not prove a mantle origin for the methane because the gss may have been 'stripped' out of the crust with upward movement of 'He" k must of course be the other way around "He is never present at a level of more than one part in 107 of any natural gas. How this minute trace constituent would sweep up more than ten million timesits rown volume as it moves through the crost would surely be a major puzzle. It is more rensonable to suggest that the COs and isotopically heavy CH; are carriers for the "He with which they are so often found associated.

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Thomas Gold and Steven Som Centry for Radiophysics and Space Research Cornell University Ithaco, NY 14833

Office of Naval Research Coastal Science Program (contract N00014-81-K-0033, Tak four rock-type categories liated on the constal landforms map published in the National Atlas 389-170). [U.S. Geological Survey, 1970] and subdivided

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Washington, D.C., 1970. Wood, F. J., The Strategic Role of Perigean Spring Tides, U.S. Department of Commerce, NOAA, Washington, D.C., 1976.

S. Kimball May holds a B.A. from the College of William and Mary, a M.S. in geophysics from Ball State University, and a Ph.D. in coastol processes from the University of Virginia. She is currently a reworch associate with the Virginia Institute of Ma-

ine Science and the Uniunity of Virginia. Her research has been concen-paid on the definition, classification, and predic-tion of analog coastol environments. For the past year, S. Kimball Moy has worked with the statistial analysis of regional scale constal processes, speedically the interactions among cyclone frequency, see energy, and nearshare profile response.

Robert Dolan received his B.S. from Southern Ornos College, M.S. from Origin State University, and his Ph.D. from Louisi-an State University. He has been the University University the 1865 and of Virginia since 1965 and is past choionan of the Dement of Environmental

Sciences, Robert Dolan has ben responsible for the management of numerous much projects in the coastal regions, leading to note than 100 publications on coastal processes, shordine dynamics, guidelines for classification of world environments, barrier island dynamics, and stordine erosion. His research has been sponsored by the Office of Naval Research Coastal Sciences Program, the National Space and Aeronautics Adtion, the National Park Service, and the U.S. Geologicol Survey. He has served in an adtion sapocity for the Geological Survey and Park Service and has a number of research efforts underivas related to coastal dynamics. Presently, he is urring as a lioison scientist with the Office of Naval Research in London.

Bruce P. Hayden is associate professor of Envi-University of Virginia. He unived his undergraduate elucation at Pennsylvania State University in zoology and botany and his Ph.D. from the University of Chicogo in biomeleorology.

once Harden spent 2 yan as a post-doctoral research associate within the climatology program of Reid Bryson at the Uni-tently of Wisconsin. Since joining the faculty at the University of Virginia, he has worked closely with Robert Dolan on designing experiments and as the onalysis of coastal data sets to describe re-tinulated to the coastal data sets to describe regosal-scale shore-zone processes. His publications whide contributions in constal unctenvalogy, ecolo-D. geology, and management.

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of the Beoid over the South Pacific de-tived from SEASAT and GEOS-3 altime-

ter data. Illuminations are from the north-

west (top/center) and southeast (bottom).

Shorter wayelength geold undulations re-lect bathymetric features such as large

camounts (e.g., San Felix Island at

26.5°S, 280°E) and fracture zones (e.g.,

the Heezen, Tharp, and Udintsev Frac-

lure Zones, bottom center); The largest

mear feature is the Eltanin Fracture

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Bell (News), Bruce Doc, C. Stewart Gillmor (History), Clyde C. Goad, Arnold L. Gordon, Louis I. Language.

Solar System Around Vega?

The Infrared Astronomy Satellite (IRAS), lanuched in January, has discovered a shell or ring of patticles around Vega, the brightest star in the constellation "The Lyre" and one of the brightest stars in the sky. The discovery provides the first direct evidence that solid abjects of substantial size exist around a star other than the sun; it also offers the first scientific opportunity to study what may be an early solar system accreting from stellar debris, much like our solar system is believed to have formed.

IRAS measured the material to be at a temperature of 90° Kelvin, about the temperatime of particles in Saturn's innermost rings. Although the sensitive telescope on IRAS cannot discern the individual particles around Vega, acientists speculated that the particles could range from the size of a peatl to the size of an asteroid or planet. In additinn, the composition of the particles is open to debate. The material around Vega probably has not reached the same stage of evolution as our solar system hecause Vega is less than one fourth as old as our sun.

Vega, about 26 light years from earth, is a standard against which other stars' beightness and spectra are measured by astronomers. In fact, it was while IRAS scientists H. II, Aumann of the Jet Propulsion Laboratory and Fred Gillett of Kitt Peak National Observatory were using Vega to calibrate the IRAS telescope that they discovered that the star appeared much brighter and larger in infrared light than expected based on IRAS observations of similar stars. The scientists eletermined that the radiation is coming from an extended region around the star stretching om roughly 80 astronomical units from Vega. Anmann and Gillen were working with telescope data at the IRAS tracking and data acquisition cemer at the Rutherford Appleton Laboratory in Chilton, England, when they made the discovery.

The IRAS infrared relescope measures heat radiation emitted by celestial objects. The telescope is scheduled to operate through January; its mission is no survey and map all infrared objects in the sky. Followup studies from infrared, optical, and other telescopes will gather information on the distrition and composition of the material. IRAS is a joint project of the United States, the United Kingdom, and The Netherlands. The Jet Propulsion Lahoratory is the U.S. management center for IRAS.

New Editors Appointed

The Weekly Newspaper of Geophysics

Cover. Enhanced sun Illumination image | Zone, which is associated with a major age

cations Office.

New editors have been apppointed for the Atmospheres and the Oceans sections of the Journal of Geophysical Research (JGR), for the policy sciences portion of Water Resources Research (WRR), and for Reviews of Geophysics and Space Physics (RGSP).

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offset in the seafloor. The northwest ex-

tension of this fracture zone is the Louis-

ville Ridge. The Kermadec Trench ap-pears in the northwest corner. In addition

to these known features, this map reveals

mounts that have not been detected prev

ously or were poorly charted because of

sparse bathymetric coverage, (Phote courtesy of David T. Sandwell, National Geodetic Survey, Rockville, Md.)

a number of fracture zones and sea-

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hysical Union unless expressly stated.

William L. Chameides, associate professor st the School of Geophysical Sciences at the Grorgia Institute of Technology has been appointed editor of JGR-Armospheres beginning January I, 1984. He succeeds Ralph Gi-

Chameides, who has been an associate editor JGR and Geophysical Research Letters (GRL). rereived his B.A. in physics from the State University of New York at Binghanton in 1970 and his Ph.D. in grology and geophysics from Yale University in 1974. Manuscripts submitted to JGR-Atmospheres after October 1, 1983, should be sent to William L. Chameldes, School of Geophysical Sciences. Georgia Institute of Technology, Atlanta, GA 30352 (telephone: 404-894-3883).

James J. O'Brien, professor of meteorolgy and oceanography at Florida State Universit (FSU), has been appointed editor of JGR-Oceans beginning January 1, 1984. He succeeds A. D. Kirwan, Ir.

O'Brien, director of graduate studies at FSU's department of meteorology, received his B.A. in chemistry from Rutgers University in 1957 and his Ph.D. in meteornlogy from Tesas A&M University in 1966. He has served as an associate editor of GRL and is the immediate past president of the AGU Oceanugraphy Section. Manuscripts submitted to JGR-Oceans after October 1, 1983, should be sent to James J. O'Brien, Editor, JGR-Oceans, P.O. Box 2173, Tallahassee, FL 32316 (telephone: 904-644-4581).

Runald G. Cummings, professor of economics at the University of New Mexico, has been appointed editor of the policy sciences section of WRR beginning January 1, 1984. He succeeds Jaretl L. Culion.

Cummings, director of the university's program in natural resources economics, received his B.S. in economics from the University of Missouri in 1963 and his Ph.D. in economics from the University of Missouri in 1968. He was chairman of the department of cesource economics at the University of Shode Island from 1972 to 1975 and is presiilent of the Association of Environmental and Dominico Francists Manuscrints submitted to WRR after October 1, 1983, in the policy sciences of water resources including economics, systems analysis, sociology, and law. should be submitted to Ronald G. Cummings, Department of Economies, University of New Mexico, Albuquerque, NM 87131

(teleplinne: 505-277-3056) lantes R. Heirtzler, senior scientist at the parament of geology and geophysics at the Woods Hole Decanographic Institution (WHO1), has been appointed editor of KCSP beginning July 1, 1984, succeeding Andrew F. Nagy; Heitzler will be editor-designate from January 1 to June 30, 1981. Papers submitted to RGSP through the first quarter of 1984 should continue to be sent to Nagy.

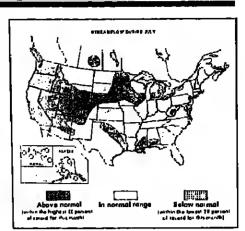
Heirtzler, who has published extensively in the field of geomagnetism, is the president of AGU's Geomagnetism and Paleomagnetism Section and was chairman of WHOI's depart ment of grology and geophysics from 1969 to 1976. He received his B.S. in physics from Louislana State University in 1947 and his Ph.D. in physics from New York University in 1953. Heirtzler was director of the Hudson Laboratories of Columbia University from 1967 to 1969 and director of scientific research of the Joint Oceanographic Institu-tions, Inc., in 1979-1980.

July Streamflow

The lingening effects of a record-deep mountain snowpack rontinued to keep streamflows at near record high levels in much of the western United States during July. Elsewhere in the nation, a lack of rainfall and prolonged high temperatures con-tributed to declining streamflows, and parts of the northeast and southeast reported near record-low streamflows, according to a monthend check on water conditiona by the U.S. Geological Survey (USGS). courtesy of USGS.)

USGS hydrologists said that record-high streamflows were set in California, Colorado Oregon, Utah, Washington, Wyoming, and lows based on reports from 172 key index stations across the country. Well above average flows during July, within the highest 25% of record, were reported at 57 of the Index gaging stations. Of the remaining stations, 98 reported near-average flows and 17 reported well below average flows. Along the east coast, 12 of the 72 key Index stations from Maine to Florida reported well below overage flows for the month. In the extreme southwest, two stations reported their lowest July flows for the period of record.

The combined flow of the three largest rivers in die coterminous United States-Mississippi, St. Lawrence, and Columbia—which drain more than half of the 48 states; reflected the generally wet conditions. The average flow for the three rivers during July was 8346 billion liters per day (bld) (736 billion gallons per day), 20% above average, but down sessonally by 48% from June's flow. The flow of these large rivers serves as a con-venient check for hydrologists in appraising he nation's surface water conditions.



Working in cooperation with federal, state and local officials, the USGS routinely monitots the quantity and quality of the nation's surface and groundwater resources at more than 45,000 stations across the country. Flows of the "Big Five" rivers in July were as fol-lows: Mississippi River at Vicksburg, Miss., 1614 ldd, 29% above average for July, but 56% below the near-record flow in June; Columbia River at The Dalles, Ore., 905 bld, 10% above average, but 34% less than last month's flow; St. Lawrence River near Massena, N. Y., 827 fdd, 3% above average, but down 5% from Junie's How; Missouri River at Hermann, Mo., 323 bld, 45% above average for July, but down 28% from June; and the Ohio River at Louisville, Ky., 150 bbl. 45 above average, but 30% below the June flow.

News (cont. on b. 524)

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NSF Education Grants

The National Science Foundation (NSF) is soliciting proposals fur the development of educational materials and training workshops for science and mathematics programs in ele-mentary and secondary schools. Proposals may be submitted at any time and must specifically deal with projects in mathematics, engineering, the natural sciences (including atinospheric, earth, and ocean sciences, physics, astronumy, eliemistry, and biology), and o-mputer science.

Projects for materials development may deal with programs for the continuing education of teachers; the development of teaching aids to improve classioon instruction; analy ses of current elementary and secondary level programs; the improvement of communica-tion among professionals in the field; or applied research directed at understanding and improving instruction and learning.

Proposals for workshups may offer to es-tablish guidelines for identifying effective teachers and improving the prestige accorded them; to concluct workshops which offer specialized training; to create workshop materials; to improve the impact of workshops; or to conduct surveys during workshops in order to identify current trends and problems.

The current hudget for the unterials development program is \$12 million; the budget fur the workshop program is \$2 million.

NSF will evaluate submissions on the basis

of the quality of personnel participating in the project, on the inclusion of appropriate contributions from various private and public sectors, on the effectiveness of the internal evaluations built into the project, on the design quality of any proposed products, and on the potential impact the project may have

for improving current educational programs. All proposals simuld reflect an awareness of the diverse needs of different teacher and student populations. The foundation strongly encourages winner and minorities to enter the national competition for these grants. For more information contact Materials

Development (or Honors Workshops) for Precollege Science and Mathematics, Office of Scientific and Engineering Persunnel and Education, National Science Foundation Washington, DC: 2055tt (relephone: 202-357-

New NAS Journal

In April 1984 the National Academy of Sciences (NAS) will begin publishing a new quarterly focusing on science policy. Written primarily for legislators, diplomats, corporate lagers, security analysts, and other public policy analysts, the new journal will deal with i diverse topics as arms control, economic

competition, social change, and health care. Original articles are expected to create a 120-page periodical that will discuss policy is sues on a sophisticated but nonspecialist level, in a manner similar to that which Foreign Af-foirs uses to discuss U.S. foreign policy topics, nccording tu NAS.

The National Academy of Engineering and the Institute of Medicine will be copublishers

Geophysicists

The fullowing AGU members were elected Fellows of the American Association for the Advancement of Science (AAAS) on May 30: Bruce Blanchord, Thomas E. Eastler, Robert L. Fleischer, Hans-Walter Geargil, Neil S. Grigg, Chester W. Newton, Louis G. Pahiser, Jr., Willord J. Pierson, Jr., Molcolm Ross, Harlon J. Smith, Robert L. Smith, Victor D. Vaegnier, Jo-soph Veverho, Fred N. White, and Chorles A.

Larry D. Brown has been elected associate professor of geological sciences at Cornell University. Brown is a co-principal investiga-tor of COCORP (Consortium for Continental Reflection Problings.

Vernon E. Derr, a physicist and for the past 3 years deputy director of the National Oceanic and Atmospheric Administration's (NOAA) Environmental Research Laboratories (ERL) in Boulder, Colo., has been appointed ERL director, effective last month. He succeeds Gearge H. Ludwig, who resigned from the post in June (Eas, July 19, 1983, p. 459). Derr is a specialist in spectroscopy and laser development and application. A pioneer in the use of lasers in studying the properties uf clouds and aerosols, his current research focuses on the optical properties of clouds and their effects on climate.

A. Ivan Johnson, a consulting engineer, re-ceived the 1983 Frank W. Reinhart Award from the American Society for Testing and Materials (ASTM). He was cited for his leadership on nomenclature for soil and rock me-

Nominations for Medals and Awards

William Bowle Medal. Awarded for outstanding contributions to fundamental geophysics and for unselfish cooperation in research.

Maurice Ewing Medal, Hunors an individual who has led the way in understanding the physical, geophysical, and geological processes in the ocean; who is a leader in ucean engineering, technology, and instrumentation; or who has given distinguished service to the marine sciences.

Robert E. Horton Medal. Given for oulslanding contributions to the genphysical aspects of Hydrology. James B. Macelwane Awarda. Up tu three awards are given each year for significant contributions to the geo-

physical sciences by a young scientist

of outstanding ability. Reciplents must be less than 36 years old.

After a general overview of the more important milestones in climate change research Letters of nomination oullining significant contributions and correction covering both facts and theories, the authur vitae should be sent directly to the discusses the evolution of armosphere with a special emphasis given to the carbon cycle, appropriate committee chairmen: stressing the importance of ocean-biusphere Bour Medal - Eugene M. Shoemaker, U.S. Geological Survey, 2255 Geniai atmosphere interactions. This could have Drive, Flagslaff, AZ 86001; Ewing been well described in a flow cliagram, but the six-page summary gives a good idea of Medal - Robert O. Reid, Department the main processes respunsible fur it. This of Oceanography, Texas A&M Unithapter ends with the variations in the chemiversity, College Station, TX 77843; al composition of the atmosphere on geologkal time scales dealing especially with carbon dioxide and oxygen and their related effects Horton Medal - R. Allan Freeze, Department of Geological Sciences, on living bodies. The two main cunclusions University of British Columbia, are that variations in atmospheric Oz content Vancouver, B.C., Canada V6T 1W5: definitely influenced the evulution of the ani-Marchana Award - J. Freeman Gilbert. mal world, whereas fluctuations in the CO2 IGPP A-025, University of Californial concentration were accompanied by varia-San Diego, La Jolla, CA 92093. tions in the mass of autotrophic plants and consequently by variations in the total mass of

author thought it was timely to tie together

results obtained during the past 10 years.

The very last papers are not included, but

to western scientists.

living matter on our planet.

Chapter 3, one of the two more original

chapters (the other being chapter 6), licuses on a semi-empirical theory of climatic change.

There is an excellent description of the newly

improved maps of the heat balance compo-

nents of the earth-atmosphere system that have been constructed and published in Rus-

sim by Budyko et al. in 1978. From the data

given in Table 3.2, it can be seen that as the

heat halance at the earth's surface improves.

the values of absorbed short-wave railiations

146% of the solar constant), of radiation bal-

ance (81%), and of heat loss from evapora-

approach the results obtained by Houghton

in the 1950's except for the turbulent heat

ing more general climate theories to the

study of its changes, M. I. Budy ko attempts

to use for this purpose semi-empirical mod-ek, which can be done only at the expense of

restricted goals for the model, extensive pa-

cesses, and the use of empirical relation

dyko describes extensively a sensitivity analy-

the f his seasonal model for variations in the

solar constant and in GO2 concentration. Un-

discusses the stability of his simulated climate,

pointing out the stable (e.g., white earth) and

untable glaciation regimes. For example, he concluded (1) that for the existing climate-

seems not to be unique (that is, a different cli-

matic regime could exist as a new variant of

partial glaciation of the earth with a larger

area of ice coverage compared with that presently observed) and (2) that an ice-free re-

gime would also take place if the heat income exceeds its present value. Taking into account

that these results depend essentially on the al-

phere system with and without snow and ice

over, he derived that relative estimates of a

eterizations of the latitudinal distribution of

the albedo, which could cause a glociation of

bereas the most probable values are 3-5%.

However, the problem of earth's glaciation

bould be studied further to elenr up lucron-

detely solved questions, such as the station-

y nature of the climate system and the ef-

lest chapter is devoted to natural climatic

changes. The main interest of the author was deliberately COs, and very few pages are de-

late tectoaics, and internal mechanisms such

at atmospheric carbon dioxide is the

med to solar variability, astronomical varia-

ions of the elements of the earth'a orbit

doudy polar ice and other albedo feed-

Tause of the prevailing changea in tempera-

Mory, its atmosphere probably contained

mough CO2 to maintain fairly high air tem-

Perstures near the earth's aurface; (1) in the

tarly and middle Phanerozolc (600-300 mil-

by years ago), the CO2 concentration was 6-10 times higher than at present (with a peak around the Devonian-Carboniferous), and

the greenhouse effect made up for the lower

rate of the solar constant; (2) In the late

Mesozoic (roughly 100 million years ago) it saned to decrease gradually, leading to the

tenary ice age where astronomical factors sared to influence the climate significantly only after the development of polar caps.

he post-pleistocene climatio variations are

then presented with a long discussion (98: page) on the thermal and precipitation re-

Tenlary cooling treod and finally to the Qua-

solar constant decrease for various parant-

the earth that lies in the 2-10% interval,

edo parameterization of the earth-atmo-

forming factors, the present-day climate

der the title "Unambiguity of Climate," he

rameterization of large-scale atmospheric

hips Besides his annual mudel, M. I. Bu-

Taking into account the difficulty of apply-

tion (26%) appear to increase by 16-20% and

usaled fur by a good overview o Russian literature that is usually not available

Deadline for Nominations is November 1, 1983.



chanics and his work on the development and maintenance of definitions of terms relating to soil and rock mechanics. The Frank W. Reinhart Award is presented by the Society Committee on Terminology to a technical committee, subcommittee, or ASTM member who has made an outstanding and unusual contribution to ASTM in terminology stan-

Clifford Murino was elected president of the University Corporation for Atmospheric Research (UCAR) by the UCAR Board of Trustees. Currently president of the Desert Research Institute of the University of Neva-

da system. Muriou will hegin his duties as UCAR president on September I. He sur-ceeds Rabert M. White, the new presidents the National Academy of Engineering Before assuming his University of Nevada pog

rine gerdogical and oceanographic research

In Memorion

Eric S. W. Simpson, a leading figure in ma

Books

The Surface of Mars

M. H. Carr, Yale University Press, New Haven, Conn., xiv + 232, 1981, \$45.

Reviewed by Peter H. Schultz

Surface features revealed by the Viking Orbiter were 10 times smaller than those recorded by Mariner 9, 30 times smaller than those features seen from Mariners 6 and 7, 300 times smaller than those features in Mariner 4 images, and 15,000 times smaller than our best pre-1964 earth-based views. The book about Mars had to be rewritten following each increase in resolution. Mutch et al. (The Geology of Mors, Princeton University Press, Princeton, N.J., 1976; and W. K. Hartmann and O. Raper (The New Mors, NASA Spec. Publ. 537, 1974) provided us rewrites following Mariner 9. Carr provides us a comprehensive rewrite following the historic Vi-With the diversity of perspectives possible,

Carr focuses on surface features. The Surface of Mars may appear to be a geomorphic text, but it is much more than simply descriptions of features. Carr concentrates on the broader implications of features such as their clues for past fluvial activity and evidence for a different paleo-climate. Such implications are not dropped but are used to link different disciplines auch as the evolutions of the atmosphere and the interior. Such an approach might seem narrow to some and frustratingly broad to others, but it is a view that permits Carr to pose the must basic questions and in consider first-order answers. He presents a somewhat personal view by no means singular or with number vision. As leader of the Viking Orbiter Imaging Team, he witnessed conflicting and evolving interpretations while the Viking Orbiter relayed new data. Much of this evolution of thought is extensively referenced to current research (up to late 1979), including his own uninion of controversies and judgments. Although some may argue with his opinions, the approach provides a coherence difficult to achieve in group-authored or chapter-authored books. It also serves to focus points of contention, to challenge those with conflicting ideas, and to reveal broad areas remaining to be studied.

Perhaps the greatest strength in this book is the overall clarity of style and methodical approach. He treats Mars as its own planet, much as a terrestrial geologist treats the earth. We are not overwhelmed by terrestrial or lunar analogies, just as a terrestrial geology text is not overwhelmed by lunar or martian analogies. He introduces Mars in a concise overview that describes its surface and

processes, thereby familiarizing the newconter with its place among the inner solar system planets. As greater tletail is considered in subsequent chapters, he interjects his own observations and interpretations, which occasionally are lost in the syntheses of other research. But such personal contributions provide a subtle and important thread that holds the book together. This approach, which brings solidity to the book, also brings an occasional impression that the surface of Mars is well understood, an overstatement underscored by the diversity of features and equal diversity of interpretations.

Because Carr has produced a personal view, I have several personal quibbles. The historical perspective provided in the first chapter is adequate but lacks important refer ences and a good view of the pre-1967 observations of Mars. For example, no mention is made of pre-mission conferences such as the results from the 1965 CalTech-IPL Lunar and Planetary Conference or the systematic astronomical studies of Mars such as C. F. Capen's report about the 1964-1965 Mars ition. Only token reference is made to de Vaurouleur's classic text about Mars. Such references are important, not only for a full picture of pre-Minner efforts but also to instill a certain caution in accepting current

"truths" with our present yet still incomplete data sets or parochial viewpoints. The book is profusely illustrated with Viinages and salient graphs or diagrams from journal articles. In contrast with Mutch ct al.'s book, The Geology of Mars, however, very few of the nonphotographic illustrations are original. In several instances, sketchea or explanatory diagrams could have substantially clarified conflicting interpretations or described processes. Carr provides, nevertheless, a generally coherent discussion of a wealth of facts and roncepts. Only occasionally are there lapses in understanding or communication. For example, on page 15 Carr uses the absence of craters in the polar deposits as evidence for recent formation, whereas in fact it indicates active processes that can continuously reshape an old aurface. On page 30 he defines "optical depth" for the reader but introduces it on page 27. He presents a somewhat confusing account of the formation of central peaks on page 43, not distinguishing between slope failure (slumping) and plastic flow of the impacted region. He also notes that plus are rare on the moon and Mercury, but such features are certainly

clearly that these regions have a wealth of de-tail, and the quoted Mariner 9 view largely reflects the effect of haze and oblique viewing angles, a lesson actually learned from Mariners 6 and 7. Carr ronfuses the accepted usage of the terms impact crater "saturation" and "equilibrium" on page 57, and he switches from incremental crater distributions to cumulative tlistributiona without explanation or warning. On page 70 he implicitly assumes that ridges indicate volcanic plains, but in other sectiona of the text he clarifies this assumption. In the section on the poles, Carr does not clarify the distinction between the polar cap and the polar layered terralits.

Such mitpicking also applies to editorial and layout errors. For example, upsidedown or sideways photographs occur, but are rare. Several misspellings, truncated sentences, and editorial glitches also were found. Although dimensional scales were ennsistently given for the martian images, ironically they were generally absent from terrestrial photographs. Such criticisma are relatively minor and perhaps stand out only becuase of the otherwise excellent production

I found The Sprface of Mars a stimulating reference that should be on the shelf of auyone wishing a detailed look at the geologic evolution of another planet. But the last word on Mars has not been written. Large quanti-ties of relevant material have been published since 1979 that either are not referenced here or are referenced very imcompletely. This is not damning criticism. This is merely teatimony that the study of Mars does not simply end at the end of the final mission report. Mike Carr's book provides ua a comprehensive status repon, li atimulates researchers active in the field both by its synthesis of diverse data and by reaction to his personal views. I am sure this is what he wanted.

Peter H. Schultz is with the Lunar and Planetary Institute, Houston, TX 77058.

The Earth's Climate: Past and Future

M. I. Budyko, Int. Geophys. Ser., vol. 29, Academic, New York, x + 307 pp., 1982, \$89,50. Reviewed by A. Berger

This is not simply another specialized book common on the moon. On page 62 Carr hensive review of the scientific contributions furthers the idea, based on Marinar 9 images, of M. L. Budyko and his colleagues from the ommon on the moon. On page or carr furthers the idea, based on Marinar 9 images, of M. I. Budyko and his colleagues that extensive marining has produced the Soviet Union.

Soviet Union.

A J. Budyko from the Main Geophysical higher resolution Viking images have shown Observatory in Leningrad, is an object ding.

climatologist well known in the field of dimate modeling. His results have been pub lished or translated into English. Among them let us remember his Atlas of the Heat Baloner, Climate and Life, and Climate Chango Since the 1960's, M. I. Budyko has been

Climatic Changes by M.I. Budyko (1977)

English translator, R. Zolina English translation editor, L. Levin

Budyko diecueses the effecte of climatic changes on blological processes, including the evolution of tiving organisms and examines specific ellarations in micro as well as mado climelic conditions. The author present the need to develop methods - and oflare auggaetions — to modify the earth's climete. Climatic Changes is must

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in 1980, Marina had been director of the Xa tional Center for Atmospheric Research's (NCAR) atmuspheric technology division le 5 years. Before naiving to NCAR, bespen 20 years at Saint Louis University in various

died in June. A professor at the Universital Cape Town in South Africa, he was a format president of the Scientific Committee on Oce anic Research (SCOR) and was chairmand the Commission on Marine Geology of the International Union of Geological Science (IUGS). An AGU Life Mendler and a nonber of the Teconophysics section, he joint AGU in 1971.

lished mainly in Russian, but several important papers and books were fortunately pe

very active in research on man's impactor the environment, drawing the conclusion in a drastic change toward warning will occur during the next few decades if modern trends for generating energy continue. At is now wirlely believed that authropogenic nutile change is indeed highly probable for

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This classic volume discusses the

climates of the past. reeding for all those interested in clining and olimetto modification.

the century. This was followed by a slight temperature dip, which was soon replaced by a rapid temperature increase. The warming was especially marked during the rold season in the late 1910's and early 1920's. The positive temperature anomaly was greatest at the end of the 1930's; in the 1940's the warming trend was overcome by a cooling trend, which intensified in the 1960's. In the mid-1960's the mean air temperature in the northern hemisphere approached the level of the late 1910's.

Reasons for this present change in climate are then found in volcanic activity and in the atmospheric CO2 concentration brought by man's economic activity. This is why chapter 5 is totally devoted to the changes in local and global climate induced by man. Budyko's nonstration of the carbon dioxide influence on climate is in general agreement with the scientific works published before the appearance of the Russian version of his book (1980). As a consequence, he did not include the most recent results that the increase in atorospheric CO2 and its related change in temperature could be much less than was previonsly thought owing to a reduction in energy consumption and a diversification in energy production. This explains why he still predicts a temperature increase of 0.5°C by the year 2000 and 2.5°C by the year 2025 fand not around 2075 as is now believed) with a northward shift of the growing thermal zones by 1°-3° and by 10°-15° latitude, respectively, comparison with present-day conditions. Very little is said, however, about early detection strategies of CO2 climate signal and about the influence of other trace gases, the transient response of the climate, the role of the oceans, and the cloudiness radiation feedback, all factors that can alter the climate response to CO2 forcing.

The last chapter deals with the distant future of climate and the biosphere. Here it must be pointed out that forward calculation of the astronomical variations points to a new ice age beginning within about 5000 years and not the 10,000-15,000 years mentioned in the book on the basis of an outdated calcu-

Against this background, Budyko's conclusions are that "By using the coal and oil re-serves accumulated for hundreds of millions of years, man is restoring the chemical composition of the Late Terriary period. . . . If this change in natural conditions occurred rather slowly, this process could be favorable for mankind. But the enormous rate of this process creates a number of problems whose solutions can not be so easy. . . . In connection with this, it is necessary to organize, as quickly as possible, broad interdisciplinary instigations of anthropogenic climatic thanges and their impact on natural condi-tions, such studies having to be based on inernational cooperation.

Ahliongh Budyko's book may overemphasize the importance of carbon dioxide among all causes of climatic changes, climatic warming owing to carbon dioxide and other trace ses nonetheless has to be taken seriously. Budyko has long been actively involved in concern over man's impact on the environment anti on climate. His experience made this book a landmark in the development of climatology, and his view on biosphere and climate motle it not only important but also of with interest.

Andre Berger is head of the Institute of Astrono-my and Geophysics Georges Lemaitre of the Gotho-lic University of Louvain-lo-Neuve, Belgium.

feet of the changing atmospheric chemical composition (which explains the lack of traces River Basin Planning: Descrice of the earth's complete glaciotion during Pre-cambrian times). This is why M. I. Budyko's Theory and Practice

S. K. Saha and C. J. Barrow (Eds.), Wiley-Interscience, New York, xiil + 357 pp., 1981.

Reviewed by Ethard F. Joeres

River Basin Planning Is divided into three major parts and an appendix, Part I, Theory Although not all geologists or elimatologists of River Basin Planning, is led by an i ductory chapter from the editors emphasizthe of the geological past and/or of the past century, the author stresses the remarkable is he believes to exist between CO2 and temperature. ing the major human component in the complex sociotechnical attributes of river basin development. They present a focceful argu-ment for a truly interdisciplinary approach to petature curves. For most of the earth's early river basin planning. (The appendix subsequently suggests curriculum development for courses in river basin planning.)
Part 2, River Basin Planning: Environmen-

tal lasues, is supported by two chapters; one with a focus on soil conservation, the other on ecosystem protection. The soil conservation chapter by I. Douglas illustrates that slow, inadvertent changes may be more damaging in the long run than immediate, direct effects. It postulates that planning for people perforce will require planning for soil conservation as an ongoing activity. The case for environmental protection is somewhat weak because of the singular example chosen for illustration. The Guning Mulu National Parkin Sarawak, Malaysia, is in a fragile, humld,

tropical forest region where any change per se is interpreted as being detrimental.

Part S, by far the largest fram of the book.

is entitled River Basin Planning: Socioeco-nomic lasues. Its chapters are divided into fines variations during the last century.

From the Russian works, Budyko concluded
that a warming the last century is the sed of the hat a warming trend began at the end of the 19th century in the extraequatorial latitudes of the northern hemisphere, with a weakly three general groups in group one, a num-ber of chapters deal with postdevelopment Monounced maximum just before the turn of

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analyses of a variety of water development schemes, R. P. Lightfoor analyzes the resettleent experience associated with 11 major water development projects in Thaikind; R. Winid looks at development achievements in the Awash Valley of Ethiopia; M. J. Shepperdson considers the demographic, environ mental, and socioecomonic consequences of the vast irrigation scheme in the Indus River Basin of Pakisian; and E. Street analyzes the role that inespensive power from the Ten-nessee Valley Anthoniv has played in the economic, social, and environmental develop ment of that region

Another group of chapters is methodologi-cal, intended either to dhistrate possible development scenarios for the future or as pedagogical devices used to train planners in the complex decision processes necessary for wa-

ter resources planning.
Included in the methodological group is the chapter by L. V. Tavares on a mathematical systems model for a large, multipurpose water resources project currently underway in the Alentejo Region of southern Portugal; the model selects the configuration and tentporal and spatial investment sequence possible for the project under given economic as sumptions. S. B. Watt presents a critical discussion of socioeconomic issues and their historical relationships for the development on the Senegal River in West Africa; and D. A. Rondinelli presents a role-playing model designed to highlight the necessary sequence of steps to be taken in irrigation planning.

A third group of chapters addresses the difficulty of translating the experience in one place into another, the economic benefits at one time into another, or the perspective of one agency into another. The chapter by A.

Blackburn and D. Hughes-Evans discusses the value of comparing different planning approaches as highlighted by management of Potentac River in the United States and the Thames in the United Kingdom; S. D. Briggs makes a case for ongoing research and development to allow for adjustment and reevaluation as uncertain socioeromonic parameiers manifest themselves through time; and 1. M. Sianu locuses on the problem of vested interests and hidden agendas that surface when two governmental agencies set out to study the same water development scheme in Oyo State, Nigeria.

found this to be a thoroughly useful book. A collection of papers such as this (17 in all) can always be criticized for vacying from the overall scheme of the book. Although there are clearly some problems in this regard, I found the range of material, as well as the applications that liave been assembled, quite remarkable. The book illustrates the importance of the many interlocking concerns-behavioral, technical, antl environmenial-which must be brought into focus if success in planning is to be achieved. Must important, the overriding importance of differing local determinants to the planning process is brought home through the broad range of examples. Although 1 might want to pick at some individual points, I would recommend the book as a valuable source for its comprehensive coverage. The most likely class application would be in a graduate water-resources planning and management sem-

Erhord F. Joeres is with the Department of Civil ond Environmental Engineering, University of Wisconsin-Madison, Madison, VVI 53706.

· Subcritical, aupercritical, quasi-

parailel, and quaal-perpendicular

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ence.

A resume and the names of three persons who would be willing to provide letters of reference should be sent to: Donald S. Miller, Chairman, Department of Geology, Rensselaer Polytechnic Institute, Troy, NY 12181.

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Chartenan invalid be capable of fortering and guid-ing surh growth.

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JUNE 24-30, 1984

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convection time dependent processes involving creep lithospheric processes waveform modelling enrihquake source determination low frequency seismology aspherical structure

Convenors: Dr. Durk Doornbus and Dr. Eyslein Husebye NTNF/NORSAR P.O. Box 51 N-2007 Kieller, Norway

> Dr. Frank Richter University of Chiengo Chicago, 1L 60637, USA Dr. Freeman Gilbert University of California, San Diego, A-025

La Jolla, CA 92093, USA For further information please write 10 Doornbos/Husebye (for residents of Africa, Asia or Europe) or Richter/Gilbert (for residents of the Americas, Austra-

Participation will be limited to approximately 80 scientists.

Supervisory Geophysicist. The National Oceanic and Atmospheric Administration (NOAA) announces a Supervisory Geophysicist, GS-13, vacancy in the National Geophysical Oata Center, Solid Earth Geophysics Division, Boulder, Cohurado. Starting ralary at GS-13 level is \$34,930, Dudies include administrative and technical artivities on helialf of the Branch; maintaining liaison with principal geophysicist nationwhie; recommending to the Division Chief new techniques and services; serving on national working groups; and practicing expert advice. An advanced knowledge of them etheral and practical applications of geophysical data, e.g., gravity, geomagnetism, selsonic reflection and related disciplines is required. For further Information and/or application procedurer, please call Mary Plumley, NOAA Personnel, at (303) 197-3102. Applications must be received by Sept. 23, 1983 to be considered.

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Professor of Marine Geophysics Tectonles/Stanford University. The Department of Geophysics, Stanford University, is seeking candidates for a tenure track position in the broad area of marine geophysics and tectonics. We seek a creative scientist with experience in gathering, interpreting, and synthesizing marine geophysical data and whose research interests cover depositional, igneous, and tertonic processes on oceanic plates and continental margins. Inquiries are invited from marine geophysicists with demonstrated scientific record in one of the above aspects of marine geophysics or tectonics, who have demonstrated on ability to they have demonstrated in ability to they have demonstrated in ability to they have demonstrated in ability to the good and research directions, and for guide and leach graduate and undergraduate students. In considering the appointment of a professor. new ideas and research directions, and to guide and teach graduate and undergraduate students. In considering this appointment we are interested in maximizing interactions with ougsdrig research groups in marine geology, plate tectonics, paleomagnetism, seismology and regional geology at Strufferd. Our new faculty member will be expected to develop a strong research program involving land gradual groups.

strong research program involving leading govern-ment and industrial participation.

Salary and rank will be commensurate with repar-rience and background. Please submit a resume, a brief description of tearling and research interests, and references to:

Dr. Anios Nur Department of Geogleysits
321 Mitchell Bulking
Stanford University
Stanford, CA 94306 Stanford University is an equal opportunity en-ployer, and encourages the application of qualifed women and minorities.

University of Califorola/Assistant Researcher.
Scripps Influsion of Oceanography invites applications for the position of Postgraduate Researcher through Assistant Researcher. Appaintment as Assistant Researcher requires a publication record. The position is in the upper ocean physics group of the Marine Physical Laboratory. Active researcher. the Marine Physical Laboratory. Active research areas include air sea interaction, internal wave and mixed layer studies, as well as doppler acoustic scusor design. Candidates should have a Ph.O. in Oceanography, Physics or Engineering as well as experience and a desire to participate in field research. Salary range: \$15,936 to \$26,800. Send curriculum viace and names of references to Professor Robert Pinkel, Marine Physical Laboratory, Scripps Institution of Oceanography, UCSD, San Diego, CA 92152. Closing date: August 31, 1983

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Research Positions/Lunar and Planetary Laboratory. The Lunar and Planetary Laboratory at die University of Arizona has research positions open for Research Scientists. Researchers at the Laboratory have access to the University's observatories, a wide range of astronomical instrumentation, a complete collection of planetary images, computers and laboratory facilities. The research ranks in the Laboratory, namely Assistant Research Scientist, Associate Research Scientist, and Full Professor. Salary levels ore commensurate with equivalent tenure-track ranks. These are not tenurable and not state-funded positions. Researchers in these positions will be expected to supply a significant portion or all of their splatfes through dedit grants and contracts.

Apilicants should aubmit a curriculum his list of publications, and the namel of three references by November 1, 1983, to L. L. Wilkehing, Difector (1983), and Leading Researchers (1984). The University of Articinal Policy of Artsonals in Education appearance (1985).

Hydrogeologist, Hydrologist, or Water Resource Plamoer. The Kansax Geological Survey, a diviso of The University of Kansax, solirita applicators for a hydrogeologist, hydrologist, or water resource planner. Permanent, full-time position subjects as near review. Salary Ranger, \$20,000,350,000 per year, depending on quadifications. Required salistations: Master'r degree in hydrogeology, hydrogy, or related water resources field. Conne soil theoretical hydrologic modeling and capability apply these mostlels to different hydrologic advetor planning problems to quaricular areas to Rasa. Preferryd spublifications: Plath, degree in one of balant fields, and 2-3 years of research experience in water resources related studies.

Freedom to constant research whim the fraction of the KLIS Genhydrology Section's programmy for grantiate study or treading; and full fash ell research requirate in excellent research field lifes.

life.
Contain Personnel Manager, Kansas Geologist
Survey, 1930 Cannam Avenue, Compus Wes, Ix
University of Kansas, Lawrence, Kansas 6604(fb.
913/861-3805) for full position description, or no
play, send resume, college transcripts, list of pollished research, and three letters of reference to
orly will be given to applications received by Oober 31. 1983. Applications will be accepted as
teriewed every thery days thereafter only the pothm in billed.

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Research Associate/Petrography-Petrology. To join a research effort almed at understanding the condensation blasty of the salar system by sizera oglas), chronical, and hattige studies of the joiler short in pribalities. Applican need at larve previous experience with interiorities hat should be a superir petrographer, skilled in the set of the SEM and electron probe. Successful candidate will be dedicated, productive, an effect on much short hatte trailly and in writing, and sill her Ph.D. in band. Vicancy expected in mid assume 1088.

Scall remains and manes of three references of L Grussman, Department of the Geophysical Scans. University of Chicagot, 5734 S. Ellis Avenue, Chicagot, 11, 60037 The University of Chicago is an Equal Opportunity/Allirmanive Action Employer.

Support Scientist U11/The National Center for Almospheric Research in Boulder,
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study of the origin and evolution of deep controls
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scales. A OOITTONAL RESPONSIBILITIES FOR
LEVEL II: participates in all phases of research
considerable responsibility for writing up results be
publication; develops and modifies computer propublication; develops and modifies computer programs; may partiripate in planning and execution
of field experiments including the planned field
phase of the Stormscale Operations and Resemhead of the Stormscale Operations and ResemMeteorology (STORM) projects manages employe
in ways continuent with UCAR policies and procdures and Affirmstive Acdon program goals, fircontrol of the storms of the above tools.

Masier's degree in the atmospheric actions with a thesis on a topic related to the above the or demonstrable equivalent of experies and interest.

with a thesis on a topic related to the above or demonstrable equivalent of experipe and interest.

Working knowledge of techniques in statistic one or more of the listed data.

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Marine Deganir Chemia. Research Associate in the Cooperative Institute of Marine and Atmospheric Sciences, University of Minuti and National Oceanic and Atmospheric Administration. Experience in GC-MS-DS and sampling from ships or aircaft desiced. M.S. preferred. Domain Charman Search Committee, D.R. Atsound, NOAA/AthML, 400 Rirkenbarker Causeway, Minuti, Florida

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DITIONAL RESPONSIBILITIES FOR LEV-ADDITIONAL RESPONSIBILITIES FOR LEV-ELLE Takes a lead role in design and implementa-tion in the areas lined above, REQUIRFS: 5 Ph.D. dissertation or equivalent evidence of in-dependent research contribution in meteorology or slowly allied field

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I Second years of productive research experience and quality of publications.

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Knowledge of atmospheric chemistry modeling, anospinge of almorphetic chemistry modeling, anotheric sewenging processor, physics of reford acid deposition, and computer programming.
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out higher level of Scientist in accombinee with the
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Empkoer.

Calrass—Department of Geological Sciences, Wigh State University. The Department of Geological Sciences, invites applications for the position of theirman, to be appointed September 1984. We stadynamic individual with administrative relented 50 Apparents. sad so appreciation for research and practice-related educational artivities. Rank it at the full professor by the fact of specialization. The department is active with it faculty and an emphasis on professional practice, as assinguising a firm commitment to basic re-

Sand a letter of application, curriculum vitae and states of three references to:

Chairman, Search Committee

Department of Configural Sciences Department of Geological Sciences-Wright State University Dayton, OH 45435.

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bert T. Hodgson. Seven Members Erwin Seibel. Six Members Harold H. Demaresi, Jr., Karyn Massoni, Paul E. Myers. Five Membem John A. Dracup, Kazuya ujita, Robert B. Smith.

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Membership Applications Received

Applications for membership have been re-ceited from the following individuals. The letter after the name denoter the proposed printary section affiliation.

Frank W. Bergstrom (H), John A. Hest (S), lawson W. Brigham (O), Jan Olof Hurgman (F), Dominique Burrus, John S. C. Curran (G), Daniel Davies (P), Michael P. Dunout (O), Gerald R. Garrison (O), Varur T. Buvanasen [11), Ross N. Hollman (A), Bounte Junes, Lubichii L. Kostov (FI), Paul Lagarc, James M. Lautmer (SS). Duncan T. Mackenzie (S). Franz N. Meixner (A), Jacques Merle (O), Kichaug Na (V), Alan E. Rufty (G), Susan L. Russell-Robinson (V), Rock Samerre (G). Minoru Sasaki (Co. Bernard Shizgal, Don Vroblesky (H), Craig B, Wall (P), Inlia A. Watts (A), Crayton Vapp (V).

Student Status

Jeffrey Alexander (O), Sang Kenn Bae (H), Ronald L. Biegel (S), David A. Boness (S), Robert S. Borch (V), Eric J. Brown [Si, Randie E. Cabeen (H), Diane H. Carlson IV), Everett F. Carter (O), David Dahl (V), Gene M. Davis [V], Edward F. Duke (V), Cheryl Lyn Dybas (O), Tracy Eanes (O), David Graham (V), Juseph Ha (S), Renty Hennet (V), Katherine Hirschboeck (H), Austin Intienwantin (GP), Tudd Allen Klug (S), Michael Leonard (S), Ellen Lettvin, Gad Levy (A), Stanley D. Locker (O), Subhashis Mallick (S), Teruyuki Matsui (T), Michael McKibben (V), Herbert W. S. McQueen (T), Javier J. Meneses-Rocha (T), David J. Mulla (H), Patrick M. Okita (V), Carol Prentice (T), Margaret P. Ricri (S), Daniel Rosenblatt, Daniel Rothman (S), J. Michael Ruoltoniemi (SA), Bradford Shermau (HI, Van Soug (V), Stephen W. Todoroff (O), E. A. Vaverka (GP), Richard Wagener (P), E. Timothy Walliu (GP), Eldean M. Ward IT), Douglas A. Wolf (V).

Union and Section

In the coming months Eos will carry hiographies and photographs of all candidates for President-elect, General Secretary, and Foreign Secretary of the Union and for President-elect and Secretary of each Section. In addition, statements by the candidates for Union offices and Section President-elect will appear. The material for the Geodesy, Geomagnetism and Paleomagnetism, and Planetology sections appears below. The slate of candidates for all offices was carried in Eas. June 21, 1983, p. 422.

Geodesy: President-elect

John D. Bossler A member of AGU since 1972; 46 years old; Chief, National Geodeile Survey, Charling and Geodelic Services, National Ocean Service, Nauonal Oceanic and Admosphene and Administration (NOAA) of the Department of Commerce Major University Geodetic Science National Oceanic and and Surveying, B.S. in Civil Engineering,

University of Physburgh (1959); M.S. in Gendetic Science, Ohio State University; was concurrently Project Manager for the New Adjustment of the North American Florizontal Geordetic Datum and Deputy Diceroit, Natiunal Geodetic Survey. His scientific experience includes developing algorithms and computer programs and performing research in support of various projects in geodery and geodynamics, Vice President, American Congress on Surveying and Mapping; Secretary, AGU Geodesy Section; Past Chairman. American Suciety of Civil Engineers, Executive Cumminee of the Surveying and Mapping Division; Secretary, Section 1 (Control Surveys) International rveys), Imernational Assoriation of Gemlesy; Member, U.S. National Committee of the International Union of Geodery and Committee on Georlery: 30 publications, 3 puldished by AGU. Recipient of two Heiskanen Awards of Ohio State University and recipiests of the 1982 Department of Commerce Gold Medal (the Department's highert award). Past Assicciate Editor, Journal of Geophysical Research.

"Gendesy lies at the center of a spectrum of

technical disciplines ranging from ones than empharize geometry, like carmgraidir, surveying and photogrammetry, to those that are based on physics, like occarography and tectunophysics. This central focus means that geodesy is well positioned to influence (and he influenced by a most diverse group of scientific lields. As part of ALIU, the Geodery Section has rended to concentrate out the phyrical side. In recent years, this interaction has proved very frontful, because increasingly precise geodetic mearurements and techniques have shed much light on rignilirant areas of geophysical research. I believe that geodesy should and will contlinue to rerve as a productive roure of information for the rest of geophysics. Therefore, I would push for clorer and mure formal conjectation between the Geodesy Section and other AGU sections in rening up AFIU meeting progrants, special symposia, and in AGU publica-tions, e.g., the Searat special issues of JGR. We should combine sessions and develop specialty conferences with other sections to but-

"But I would also stress that the Geodesy Section must not negleri its relationships un the geometric side. The new, precise position ing techniques-GPS, VLBI, laser ranging, and inertial positioning-not only yield valuable geoderanned information, for also provide surveyors with tools that can revolutionize their profession. The Georlesy Section must be holistic in its attitude and embrace all the disciplines within its purview. We must enlarge our contact with kindred societies like the American Congress on Surveying and Mapping and the American Society of Photogrammetry. Furthermore, we should nrive to fluence educational institutions to combine courses which relate to these various aspects of geodesy but are usually widely reparated departmentally. I would see to it that AGU actively sponsors or cosponsors meetings ami symposia featuring geometric geodesy and geodetic instrumentation. Thus, I maintain hat geodesy must develop in both directions—physical and geometric—and that such development will optimally benefit our pro-fession and the scientific community in gen-

ther strengthen these ties.

"I am particularly concerned that geode not lose sight of the fact that it is a science in its own right, and not just a service to other sciences. The fundamental geodetic objectives—to determine positional relationships and the gravity field—remain unchanged and continue to be interesting and important ar-eas for scientific investigations. Geodetic research will maintain its usefulness for other sciences, but those who engage in this research are first and foremost geodesists and should be proud to wear the tide."

Petr Vaniček Member since 197B; 47 years old: Professor of geodesy, University of Toronto (Erindale College) and University of New Brunswick, Fredericton. Current research interests: geody-

namics, earth gravity
field, mathematical techniques of geodesy, application of natiales in
geodesy, applications of extraterrestrial methods to geodesy, physical oceanography, theoretical elasticity. Received Dipl. Ing. degree in geodesy (1959) from the Czech Teclinical University, Prague, and Ph.D. In mathematical physics (1968) from the Czechoslovak Academy of Sciences, Prague, Worked as a surveyor at Prague Institute of Surveying and Cartography (1959–1968); consulted in numerical analysis and computer applications at Faculty of Technical and Nuclear Physics of Czech Technical University (1965-1967); research fellow and later senior scientific officer at Institute of Oceanography, Bidston, UK (1967-1969); NRC of Canada postiloctoral follow in Surveys and Mapping Branch of

EMR, Ottawa (1969-1971); associate and full professor of geodesy at UNB (1971-1983); visiting scientist, USGS Center for Earthquake Research, Mendo Park, California (1977). Currently: member of executive CGU: fellowed GAC; Sigma Xi; member of CIS, NYAS, SVU; member of Canadian National Committee for IUGG: Committee on Geodery of NAS-NRC. Anthor of 140 books and papers including 3 papers in Eos (e.g., "The maje of currentporary vertical crustal movements in Canada," with D. Nagy) and one in Reviews of Geophysics and Space Physics 1"Geodetic levelling and its applications," with R. O. Casile and E. I. Balazsi. Co-cilitor of Almouroipta Geodaction, Member of the IAG working group ness, 1:21, 1:41, 4:60, 5:63. Canadian representative on IUCG Cummittee on Recent Crustal Movements. Honors inchide: NERC (UK) Seniur Research Fellowship (1907-1969); NRC (Cargada) Postdsactorate Fellowship (1969-1971); CNPq (Brazil) Visiting Professorship (summers 1975, 1976, 1979j; NRC [USA] Senior Visiting Sciemist (1978); University of Stungart (W. Germany) Viriting Prodessorship (summers 1981, 1982); University of San Paulo (Brazil) Visiting Professorship Isummer 1981). 1978 to 1981 served on AGU GMP Committee.

Statement

"North American geodesy has been suftering from a lack of identity. This continent has seen some of the most spectacular gendetic achievements; yet, often enough these were horn under the auspices of space science, tectumolitysics, oceanography, etc. Some of my more pragmatic scaleagues will argue that there is nothing wrong with thir, throw out pho ality." I Icel, lowever, that the cause of science would be better served if geodesy were, once more, reregnized for what it ir: a scientila discipline in its own

"Geodesy is the discipline that concerns itself with the geometry of the earth and its gravity held, including the temporal variation thereof. This geodesy is as much a part of geophysics as grouncity is a part of physics. It is on these philosophical foundations that the Goodesy Sertian should congregate with the other sections of AGU. It is this position that the Geodesy Section should take when asking itself: What is there that the georlesy can do for the other disciplines and what it there the other disciplines can do for geodesy? It is this point of view that I should adopt it elected to

the presidency. "On a more down-ro-earth level, the Section may consider doing more for the promotion of AGU among professional colleagues and students alike. The premedion should include soliciting research papers as well as re-riew papers for JGR and RGSP, and soliciting manuscripts for publication in the AGU Geophysical Monograph Series. As an example of other possibilities, the Section may consider launching a campaign to evaluate geodetic content in various pertinent university pro-grams on this continent and publish the re-

"To conclude, I should like to thank the Nominations Committee for the Imnor bestowed upon me by having nominated me even though I am not a U.S. citizen."

Geodesy: Secretary

William E. Carter A member of AGU since 19BB: 43 years old: Chief of the Advanced Technology Section. Geodetic Research and Development Laboratory and VLBI Project Manager, National Geodetic Survey. Major in-

terest: the application of advanced technology to geodetic surreying for research in geodynamics, e.g., the use of Very Long Baseline Interferometry and Lunar Laser Ranging to study polar motion, earth rotation, and motiums and deformations of the Ilthospheric plates. B.S. in Civil Engineering, University of Pittsburgh, 1961; M.S. In Geodetle Science, Ohio Sinte University, 1965; Ph.D. In Civil Engineering, University of Arizona, 1973. Geodetic Officer in U.S. Alr Force, 1881-1960; Research Geodesist, Air Force Cambridge Research Laboratory Lunar Laser Ranging Observatory 1969-1978; Research Associate and Head of the Lunar Laser Ranging Observatory, University of Hawall, 1975-1976; National Geodetic Survey, 1976-present. Member of IUGG: President of IAG SSG 2.51 on Radio Interferometry; Member Steering Committee of Commission VIII on International Coordination of Space Techniques for Geodesy and Geodynamics: Member of IAU: Principal Coordinator of VLBI on MERIT Steering Committee; Member AAS. 40 publications, 5 pub-

lished by AGU, including "Frequency modu-lation of the chandlerian component of polar motion," and "Refinements of the polar mo-

uon frequency modulation hypothesis."

627

AQU (cont. on p. 528)

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AGU (cont. from p. 5271

Iames G. Marsh / member of AGU since 1971. Emplayed in the Gendynamics Branch, Goddard Strace Flight Center, sture 1984, Maior interests: precision coldt determination, geoxietic parameter estimation, and applications

of satellite altimeter data to the determination of mesoscale and global circulation. Received NASA Exceptional Service Medal in 1980. Published over 70 papers. M.S. in Physics, West Virginia University 1963.

-

Geomagnetism and Paleomagnetism: Presidentelect

Subir K. Banerjee A member of AGU since 1967; 45 years old; Professor of Geophysics, University of Minuesida, Minneapolis, Major interests: geianagnetisin. paleoniaguetism, inck tiagnetism, and history of medieval science.

B.Sc. in physics, Calentta University, 1956; M. Tech in exploration grouphysics, Indian institute of Technology, Kharagour, 1950; Ph.D. in geophysics, Cambridge University, Phil. Senior Research Associate and lecturet in georghysics, University of Newcastle-upion-Tyne, UK, 1964-1969; Senior Staff Scientist, Franklin Institute Research Laboratories, Philadelphia, 1960-1971; Associate Professor of Geophysics, University of Minnesom, Minneapolis, 1971–

1974; Professor of Geophysics at Minnesnta since 1974. Adjunct Professor of Middle Eastern and Islamic Studies at Minnesora since 1976. Visiting Professor at different times at Osmania University, India, Stanford University, and University of California, Berkeley. Visiting Scholar, Office for History of Science and Technology, University of California, Berkeley, 1977–1978. Past member of Institute of Physics, UK and European Physical Society, Editorial Board: Quaternary Research, 1976-1980. Past member, U.S. Geodynamics Committee, Working Group on paleomagnetism; Vice-Charman and U.S. representative in International Association of Geomagnetism and Acronomy, Working Group on rock magnetism, 1975-1979; NRC-

NAS Study Panel on Impact of Technology on Geophysics; Member, Program Committee for USGS Workshop on Geomagnetism, 19B2; 90 publications, 12 published by AGU; ambor of Physical Principles of Rach Magnetism (with F. D. Stacey); Sc. D., Cambridge University; listed in Who's Who in America, and American Men and Women in Science; served as Associate Editor, Journal of Geophysical Research Red, and Reviews of Geophysics and Space Physics: presently a member of the AGU Goinmittee on the History of Geophysics; Program Ghairman, Geomagnetism and Paleomagnetism section, 1983 AGU Fall Meet-

Statement

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"I thank the nominating committee for the opportunity to be considered as one of the candidates for the presidency of the section. The president of the GP section has a twofold responsibility: first, toward the membership at large, and second, to the AGU Councll by acting es a two-way channel for com-

by P.N. Mayaud

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munications. I propose to pussue vigorously both of these activities, some by continuing the excellent approaches initiated by the pt sent president and president-elect and by initiating a few of my own.

"The membership at large has justifiably heen concerned by the splitting of the nation al meetings into two de facto regional meetdags. In 1968, the year when GP was created as an autonomous section, there were til papers delivered at the spring meeting and 11 at the fall meeting. In 1982 these numbers were 59 and 112, respectively! It is hard to buck the sentiment of the membership "voting with their feet," hut it is well within our capability to work with the two section program chairpersons so that special sessions of broad national interest are alternated between the two meetings and to schedule occasional workshops of broad interest in the membership at large (such as the Rock Mag ietism Workship that I have attanged for the 1983 Fall Meeting). In this connection, if elected, I propose to use vigorously the topical Chapman conferences to bring together smaller groups of workers in GP section with similar or complementary interests, as was done at the 1982 USGS Workshop on Geo-

magnetism in Golden, Colorado. "A semud service to members is through the journals program. Following the lead of the Ocean Sciences Section, and now the Volcanology, Geochemistry, and Petrology section. I propose to publish in Ees from time to nine a GP newsletter which will inform the memhership about new researches, funding sources, instrumental developments, and, above all, about mechanisms to keep in close touch workers in electromagnetic induction studies, main lield studies, paleomagnetism, and ruck magnetism. Another area where I could be of service to GP members is by cooperating with the new editors of GRL and RGSP so as 10 increase the present minuscule percentage of articles dealing with geomagne-

tism and paleomnignetism in these journals. "There has always been a conscious effort to involve "new blood" in participating in the GP section affairs, and I myself have been a beneficiary of this in the past. I propose to pursue this tradition thoroughly be it by inviting contributions from new authors for the IUGG Quadrennial Report, or by montinating new faces as conveners for special sessions at the national meetings, and especially by making sure that an ever-increasing number of younger workers are given travel grants to actend IAGA and IUGG assemblies.

"If I am able to carry out at least some of the above initiatives and inform the AGU Council accordingly, our voice in the Conneil will be heard breed and clear. In addition, I will also seek out membership concerns about the AGU as a whole, to be voiced at the Council meetings, and cooperate with the other section presidents for the furtherance of the goals of AGU."

member of AGU since 1964; age 60; Professor of Physics, University of Alberta. Major interests: solid earth geophysics and tectonics, with empliasis on electroinagnetic induction in earth and its use in delineat-ing tectonically signifi-

cant structures; paleomagnetism; induced seismicity and lithosphere stress. B.Sc. in physics and mathematics, Rhodes University South Africa, 1943; M.Sc., 1947; Ph.D., University of Witwatersrand, 1953. South African National Physical Research Laboratory 1947-1958; University Gollege of Rhodesia and Nyasaland 1958-1963; Southwest Genter for Advanced Studies, Dallas 1964-1966;

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University of Alberta, prodessor from 1966, Director, Institute of Earth and Planetary Physics, 1975-1980, Fellow: Royal Society of Ganada, AGU, Royal Astronomical Society. Geological Association of Canada: High Kelly Fellow, Rhodes University, 1977; Visiting Fellow, Churchill College, Candoidge, UK 1978. Figurer President, CGU, Has served on numerous Canadian national committees. currently member of Canadian National Committee for the International Lithosphera Program and of Lithogrobe Steering Committee. Chairman, Division 1, IAGA, 80 pmblications, 13 published by AGU, Formerly Associate Editor, JGR: on relitorial boards of Journal of Georgia och m acul Grache teirty, Physics and themistry of the Eactle, Journal of Gradymine-

Stolement

"A prospective president of a section of AGU must be able to arrange timely sessions and workshops on topics in which the science is advancing. I must tell you how I see Genneagnetism and Paleomagnetism at this time, so that you may judge whether I might be an adequate president of the GP Section.

"The description of the geomagnetic field has recently made great strides by means of satellite data for the latitude range 50°N to 50°S. The development of periodically updated international geomagnetic reference liebla both improves the data base for workers on the core field and facilitates good majes of the crustal anomaly field. In high latitudes loub steady and transient currents in the magnetisphere and ionosphere can be studied by satellites in polar orbits, but obscure the internal field from the core and crust. High latitude satellite magnetic data thus present difficult problems but certainly contain information of

"For those working on the core dynamic problem I think interaction with paleoniaguetists is important. Paleomagnetic data have shown that the core field has been dominant ly dipolar through the last 5th my and confront the dynamo theorists with aperiodic reversals. Data for the field during a reversal are vital bin few. Intensity data are now accumulating and give further input to the dynamo problem. The palenmagnetists themselves are increasingly studying the germagnetic field rather than place kinematics. In addition to finding paleo-intensities they are using recent sediments, from lakes in particular, to investigate the nondipole lield over the last few millenia. In hard-rock paleomagnetism the correct separation of multiple companents of remanent magnetization presents a problem. For precambrian rocks accurate dating and detuition of the paleductionnal are problems often harder than the pales-

magnetic measurements themselves. Those concerned with the use of electromagnetic induction to show conductive structure confront ever-increasing data but no matching advance in inversion techniques. The combination of magnetometer arrays with magnetotelluries is being tried and may prove finitlal. Various amilicial sources of magnetic fields are in use and will simplify inversion. Ocean-floor data are heginning to open new opportunities. Even without quantitative modeling, electromagnetic data often reveal and locate structures of geotectonic significance.

"In the era of interplanetary vehicles, magnetic field data from (after planets must fissinate us all. AGU will undoubtedly continue a leading role in the study of the minguetospheres of the Jovian planets in conjunction with that of the earth. Work on the sidar wind and magnetic field, and their interaction with planetary magnetospheres, is active and important.

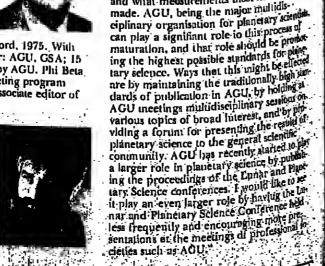
"These are some fields in which I see growth at the present time. My list is certainly incomplete. If your field is aumentioned or travestied and I am elected, it will be up to you to make good the gap in my education."

Geomagnetism and Paleomagnetism: Secretary

John W. Hillhouse A member of AGU sinre 1972; 34 years old; geophysicist, U. S. Geological Survey. Major interests: paleomagnetism, solid earth geophysics, and plate tectonics. A.B. in geology and geophys-ics. University of Cab-

fornia, Berkeley, 1971; Ph.D. in geophysics, Stanford, 1975. With USGS since 1974. Member: AGU, GSA; 15 publications, 3 published by AGU. Phi Beta Kappa. Served as Fall Meeting program chairman of GP section; associate editor of

John L. LaBrecque A member of AGU since 1975; 36 years old. Presendy a Senior Research Associate at the Lamont-Doherty Geological Observatory and a member of the Co-lumbia University Facul-ty: Received his 8.5. from the Columbia



School of Engineering in 1969, M.Ph. and Phal. From Calumbia in marine geophysic PU55 and 1977 respectively. In 1981 send as research begoniable at the Laboratorio di tirologia Marina of the Italian CNR at Bok gna. Has over 22 publications, which include studies of the geomagnetic reversal history. magnetostratigraphy, plate tectonic history the South Atlanto , Indo-Atlantic and Red Sea Basins, investigations of intermediale wavelength magnetic anomalies over the North Parille, and the development of par sive continental margius. Has served the DSDP both as a member of the Southers A lantic working group and a co-chief somis aboard Leg 73 of the Glomar Challenger during an extremely successful application HPC technology to magnetostratigraphy. Charmenly conducting active research in the geologic implications of intermediate wave length magnetis anomalies, Ar acticand South Atlantic plate kinematics, and the may metic arronnally parterns over transition zone at passive continental margins. Also acides areas of satellite data analysis including the NAVSTAR, MAGSAT, and SEASAT data se

Planetology: President-elect

Michael H. Carr A member of AGU since 1965; 47 years old; Geobigist with the U.S. Geological Survey, Ma-- 4 jor interests: general geology of the planets; planetary volcanism: history of fluvial processes and volatiles on Mars. H.Sc. in goology, University College, Landon, 1956; Ph.D. in geology. Vale University, 1960. Research associate. University of Western Omario, 1960-1902; with the U.S. Geological Survey since 1962; Chief, Branch of Astrogeologic Sudve 1974-1978. Alember AGU, GSA, AAAS, 8) publications, 14 published by AtiU; autore The Suction of Abox published by Yale Unice sity Press. Served our several advisory comes tees to NASA: Linux and Planetary Review Panel; Planetary Geology Review Panel, Pan etary Geology Working Roup, NAS-Commitee hir Planetary Exploration, Leader Videt Orbiter Longing Team; idember Mariner 9. Voyager, and Galiley science teams. Associ editor Ionos, associate relitor JGR Red. NASA modal for Exceptional Scientific Achievement, 1977; Department of Interior Meritorious Service Award, 1980.

"The last tew years have been both enderating and discouraging for planetary source Missions to Venus, Mars, Jupiter, and Sams have been specta ularly successful, but finding for research and nealysis has declined, and new missions, die lileblast of the scione, have been difficult to initiate. The rate of appreciation of new data has slowed consterably and will remainent a low level for at least 5 years. However the mitlook now appears to be changing. The long dedice in a search funding has been arrested, if not coversed, and a new philosophy for designs danctary infesions, initiated by NASASSM System Exploration Contmittee, has led mop timism almost the leasilibity of sustaining? sound program of scientific explorational the planets despite tight liscal constraints. This optimism appears justified in view of cent approval of a Venus Radar Mapper no sion and saudements to NASA's plantary exiduration hadget. These developments have several implies

tions for the Planetology Section of AGU.

The pause in data taking should lead to a maturation of the science. For most pla bidles the recommaissance has been done and Phone: 714-540-5905). the initial, quick interpretations have been made. Now is the time for consolidation, for integration of the results from differented plines, and for a more thorough and exhautive analysis of the dato in hand. Such a perod of reassessment is not only desirable for the health of the science but is also necessify for a balanced, ongoing exploration pro Because of the fiscal constraints, future me slons will probably be much more marrow focused than past missions. They will lend a address a limited number of specific prob lems rather than the science of a planet at a whole. We then must be in a position to judge which are the most pressing problems and what measurements most need to be made. AGU, being the major multidisciplinary organisation for planetary scients.
can play a signifiant role to this process of can play a signifiant role in this process of maturation, and that role should be probed ing the highest possible standards for plane tary selence. Ways that this might be elected are by maintaining the traditionally high the dards of publication in AGU, by holding a AGU meetings multidisabilinate sentions on. AGU incetings multidisciplinary session of various topics of broad interest, and by plo viding a forum for presenting the result of planetary science to the general scientific community. A CLU the general scientific age attendees will be limited to 100.

Seas C. Solomen A ther of AGU since 1967, a Fellow since 1980; 37 years old. Professor of Geophysics. Massachusetts Institute of Technology. Major interests: planetary ter-

tenks, seismology. B.S. in geophysics, California Institute of Technology. 1966; Pb.D. in geophysics, M1'f., 1971, On MT faculty since 1972. Visiting Faculty. POLA, and Visiting Scientist. Jet Proportsion laboratory, 1982-83. Member: AAAS, SSA. Has served on the NAS-NRC Space Science Board and its Committee on Planetary and Lurat Exploration, and has chaired its Commine on Earth Sciences. Has also served on the Lunar Sample Analysis Team, VOIR Science Working Group, USRA Lunar and Planeasy Science Council, and Lunar and Planetary Review Panel. Gurrently serves on the Yeaus Radat Mapper Project Science Group, Geopotential Research Mission Science Steering Group, Crustal Dynamics Working Group, Planetary Geology Working Group, nd Join U.S.-European Working Group for anetary Exploration. About 80 publications, Min AGU journals. NSF Graduate and Postdorotal Fellow; Hertz Foundation Fellow;

"Planetology within AGU faces several obardes not shared by the other sections. The Seld is uniquely diverse: since the earth is obsouly a planet, one might even argue that all of the disciplines represented within AGU fill rader the planetology heading. Planetologists, defined in the more conventionally mited sense, must also split their loyalties among several organizations, of which AGU siustone. This divided boyalty is particularly ere for meetings; many idanctory scientists

Son Research Fellow; Guggenheim Fellow.

65 AGU Geophysical Monograph Board.

Part Associate Editor, [GR and Ens; currently

classe to present their most important results at the DPS meeting or the Lunar and Planetary Science Conference rather than at ome of the AGU national meetings.

What, then, should be the role of AGU in planetary science and of the Planetology Section within AGU? The primary objective of AGU is scientific communication, both among its members and between the Union and the public, including ont scientific peers in other fields. AGU, therefore, can serve two roles for planerary science. It is a focus for enery scientists, probably the broadestbased organization of its kind in the field. And it can foster communication of the discoveries and exchement of planetary science. and indeed all of geophysics, to the rest of the nation. The Planetology Section should play the largest part in the latter task, and has the additional role of keeping the other sections up to date on the most important new results in solar system science.

"The national meetings of AGU are not likely to preempt the DPS meeting or LPSC as the principal meeting at which planetary scientists share new results with each other. The national meetings should rather be used as a forms to organize informative general sessions and to cosponsor with other sections special sessions on topics that span section interesis. A recent session ilcaling with a comparison of the tectonics on Venus and the earth as a guide to the role of place tecomics in planetary evolution is one good example in the latter category. Joint functions with the VGP Section is another. AGU should also act as cosponsor for other incetings in planetary science. The cosponsorship of the Lunar and Planetary Science Conference and the publication of the Proceedings as a supplement to JGR is a laudable, large step in this direction; los AGU involvement could be extended to smaller topical meetings as well.

'AGU's publications in planetary science (JGR, RGSP, GRL) are very strong and should stay that way. In Eos, most news of interest to the planetary science community is communicated rapidy and effectively, largely

An international symposium on advance-

ments in remote sensing of land by satellite will be held in Sjoux Falls, S. D., October 4-

7, 1983. Topics of discussion will include re-

more sensing developments by the leading

countries in the field, the proposed sale of

search and development for future sensor

systems, space shuttle remote sensing pro-

jects, and developments in research on alter-

native approaches and on support systems.

The sympasium, the eighth in a series, honors the memory of William T. Pecora, a pio-

The proceeding's highlights include de-

tailed presentations on Landsat I data charac-

teristics and im the technology and the data

distribution plans for the French satellite Le Système Probatoire d'Observation de la Terre

(SPOT). Landsat 4 is a new generation re-mote-sensing satellite launched last July and

operated by the National Environmental Sat-

National Oceanic and Atmospheric Adminis

P. O. Box 80937, Sioux Falls, SD 57116, or

call the Public Affairs and Technical Infor-

mation Office at the Earth Resources Obser-

vations Systems Data Genter (telephone: 605-

594-6114). The U.S. Geological Survey, the National Aeronautics ond Space Administra-

tion, and NOAA are cosponsoring the sym-

The 18th Annual Gongress of the Canadi-

an Meteorological and Oceanographic Society

(GMOS) and the 11th Annual Meeting of the

Canadian Geophysical Union (CGU) will be held joindy in Halifax, Nova Scotia, May 29

to June 1, 1984. With a theme of The Marine

Lithosphere, joint sessions will deal with such

topics as geophysical dynamics: atmosphere, orean, and lithosphere; Arctic expeditions:

CESAR, LOREX, and FRAM; scientific serv-

ices to the offshore industry; climate change;

coastal meteorology; oceanography and geo-physics; and boundary processes.

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U.S. remote sensing satellite operations to the

privace sector, U.S. judicy on government re-

Remote Sensing

neer in the field.

tration (NOAA).

through the efforts of Peier Bell and the Eor news staff. Greater use of Eas could be made by the Planetology Section, lowever, for meeting announcements and pust-niceting reports. An effective approach taken by the Ocean Sciences and VGP sections is to appoint an Editor to organize and publish sec-

tion reports in Eos ou a regular basis. "The next 5 years will see a restocation of exciting new discoveries in planetary science. In 1986 Voyager will fly by the Utanus system, and Comet Halley will be visited by ESA, Soviet, and Japanese spacerraft; in 1988 Galileo will emer Jujuer orbit, and VRM will begin providing high-resolution radar images of the Venus surface. It will be a time when the Planetology Section should continue to play its vigorous tole within AGU."

Planetology: Secretary

Raymond E. Arvidson A member of AGU since 1972; 35 years old; Associate Pro lessor, Department of Earth and Planetary Sciences, and Fellow, Mc-Donnell Center for the Space Sciences, Washington University, Major meresis: planetary sur

faces, remote sensing, data management B.A. in Earth Sciences, Temple University, 1969, Ph.D. in Genbigical Sciences, Brown University, 1974. Faculty member at Wash ington University since 1954. Former Chair. man, Extraterrestrial Sciences Committee, American Society of Photogrammetry, Chair man, Committee on Data Management and Computation, and member of Space Science **Boatil, National Academy of Sciences. Mem**bet of several NASA advisory groups, 54 publications, 14 published by AGU. Associate Editor of Journal Geophysical Research.

H. J. Melosh A ker of AGU since 1975; 35 years old; Associate Prufessor of Planetary Science at the Luna and Planetary

lished by AGU.

Laboratory, University of Arizona, Major interests: the mechanics of impact cratering, planetary tectonics, and the application of physical principles to geologic acesses. A.B. in physics from Princetta University in 1969; Ph.D. in theoretical physics from Caltech in 1973. Postdoctoral Fellow at the Eurico Fermi Institute of the University of Chicago, 1973-74: Instructor, Assistant Professor, and Associate Professor at Galiceli 1974-79; Associate Professor at SUNY, Stony Brook until 1982. Member: Sigma Xi. Served

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Meetinas

Announcements

Geology Meeting

The Association of Engineering Geologists sill hold its 26th Annual Meeting in San Dicp, Calif., October 3-8, 1983. The program all include technical sessions on hazardous vase and hydrogeology, seismicity and fault-ing vability, landstides and slope stability, and onstruction and engineering geology. Sympois on engineering geology; mapping symbek; resources exploration, development, and reclamation; reach logging; hydrogeology engineering geophysics; and the Condinga tanaquake are also on the schedule. Several field trips will be ruffered, including one featuring the geology of urban San Die-Pand short courses on the applications of solution and on landslide hazards and their

uction will be available. For more information contact Dong Slung, denan, Registration Committee, clo Woodward-Clyde Consultants, 3467 Kurtz St. San Diego, CA 92110 (telephone: 619-2342911) or John Foster, Ghairman, Exhibitors Committee, clo Waltler Associates, 2007 Qual St., Newport Beach, GA 92660 (tele-

Planetary Plasmas

A conference sponsored by NASA entitle The Planetary Plasma Environment: A Com-Parative View will be held January 28 to Febtuary 3, 1984, in Yosemite, Galif. The prememary program includes sections on the comparison of plasma sources and energization processes that exist in the inner and outer planets as well as in comets; internal water of plasma and ionopheric-magnetopheric coupling in planetary systems; iono-ipheric processes that serve as the source of loa and the plasmo processes by which these plasmas are plasmo processes by which these plasmas are energized; external sources of plama and energy from both the solar wind and planetary satellites; and the effects of here plasma and energy sources on the composition and dynamics of the planetary maghetospheres. Because of the breadth and tomplexity of the conference topics, sections will locus on a few carefully selected exam-Ples of the processes under discussion.

A large number of invited papers are almost. ready on the agenda. The number of confer-

and A. F. Nagy are the cochairmen.

for more information contact the cocon-Was an in the conference, J. H. Waite of the NASA/Marshall Space Flight Genter (tele-phone: 205-458-5037 or 3040) or G, R. Clauer of Stanford University (telephone: 415-497-4691). P. M. Bonks, G, R. Chappell, and A. F. Marshall Space Flight Genter (tele-phone and A. F. Marshall Space Flight Genter (tele-phone and A. F. Marshall Space Flight Genter (tele-phone and A. F. Marshall Space Flight Genter (tele-thone and A. F. Marshall Space Flight Genter (tele-phone and A. F. Marshall Space Flight Genter (tele-thone and A. F. Marshall Space Flight Genter (tele-and A. F. Marshall Space Flight Genter (tele-phone and A. F. Marshall Space Flight Genter (tele-thone and A. F. Marshall Space Flight Genter (tele-thone and A. F. Marshall Space Flight Genter (telephone and A. F. Marshall Space Flight Genter (te

physics; and boundary processes.

Abstracts, not to exceed 400 words, for papers on any topic in meteorology, occanography, or geophysics will be accepted until January 27, 1984. Send submissions to S. D. Smith (GMOS) or H. R. Jackson (CGU), Bedy ford Institute of Oceanography, P.O. Box 1006; Dartmouth, Nova Scotia B2Y 4A2, Exhibits in the fields of oceanography, inc-

teorology, and geophysics will be on display.

For more information about the exhibits contact John Brooke, 24 Flamingo Drive, Halifax, Nova Scotta B3M, 187, Canada (telephone: 902-448-2932)

AAAS Meeting

The 65th Annual Meeting of the American Association for the Advancement of Science (AAAS), Pacific Division, will be field June 10-15, 1984, at San Francisco, Calif. During this meeting the American Mereorological Society and Section W (Atmospheric and Hyspheric Sciences) of the Pacific Division of the AMAS will cosponsor sessions.

Abstracts for papers to be presented at the conference must be submitted by March 31. 1984, to the program chairman, John Lier, Department of Geography, California State University, Hayward, CA 94542 (telephone 415-881-31931. The abstracts should be typed on a standard-sized sheet of bond paper and the camera-ready title and text (without paragraphs) and should fit inside a 5-inch-square (12.5-cm-square) box. A 1-inch (2.5-cm) marshould be maintained to the left of the box. Special symbols and signs that are hand-lettered should be rendered in reproducible black ink. Include the author's name, affiliation, and address at the bottom of the page. These abstracts will be published in a booklet for distribution to conference registrants.

For additional information about the conference contact Alan E. Leviton, Executive Director, AAAS [Pacific Division], California Academy of Sciences, Golden State Park, San Francisco, CA 94118 (telephone: 415-752-

Nonmembers of AAAS are encouraged to

Rural Water

The Program Committee of the International Water Resources Association (IWRA) is soliciting papers for the Fifth IWRA World Congress to be beld June 9-15, 1985, in Brussels, Belgium. In order to reflect the meeting's theme of Water Resources for Rural Areas and Their Communities, the papers should deal with such topics as the social and cultural aspects of water usage, education in and transfer of water technology, management and financing of water facilities, equip-ment and material, assessment and manitoring of water resources, water treatment, ofter native enorgy sources, legal and public health aspects; management of lategrated water projects, and management of water resources in disaster areas. Case studies of private practitioners are welcome. The official languages of the conference are English, Spanish, and French.

Authors interested in presenting papers al this conference should submit five copies of one-page abstracts, not to exceed 50 lines, to right World Congress On Water Resources, Brussels International Conference Course, Pare des Expositions, Tentoonstellingspark, B: 1020 Bcussels, Belgium (telephone: 32-2-478-48-60; telex; 25-643). The deadline for submissions is September 30, 1988.

Geophysical Year

Boldface meetlog slitter indicate orectings spoo-sored or cusponsored by AGU, A list of organiza-tion abbreviations used in the list appears below

Future AGU Meetings:

Fall Meetings Dec. 5-10, 1983, San Francisco

Spring Meetings May 14–18, 1984, Chocinnat May 27–31, 1985, Baltimore

AAAS Anterican Association for the Advancement of Science AAPG American Association of Petroleum Geolo-

gists
ACS American Chemical Society
AIPG American Institute of Professional Geologists
AMS Anterican Meteorological Society
ASCE American Society of Civil Engineers
AWRA American Water Resources Association
GSA Geological Society of America
IAG International Association of Geodesy
LAGA International Association of Geomagnetism
and Aeronomy and Aeronomy

AHS International Association for Hydrological

Sciences
LANAP International Association of Meteorology and Armospheric Physics

1APSO International Association of Physical Sci-

ences of the Ocean

IASPEL International Association of Physics of the Earth's Interior

IAVCEI International Association of Volcanology and Physics of the Earth's Interior

IAVCEI International Association of Volcanology and Chemistry of the Earth's Interior

ICSU International Council of Scientific Unions

IUGG International Union of Geodesy and Geo-

physics 1UGS International Union of Geological Sciences 1WRA International Water Resources Association

SEG Society of Exploration Geophysicists SEPM Society of Economic Paleontologists and Min-

eralogists URSI International Union of Radio Science WMO World Meteorological Organization

Sept. 5-9 48th Aramal Mescoridani Society Meeting, Mainz, Germany. (Friedrich Begenann, Met für Chemie, Postach 3008. D-6306 Mainz FRG.) Sept. 5-9 20th International Congress of the International Association of Hydraolic Research ItAHR, Mocow, USSR (Grganizing Committee of the 20th IAHR Congress, Institute "Hydraproject," Volukolamskoe Chausee 2, Moscow A-80, 125812, USSR.)
Sept. 5-9 Pentose Cunference on Blueschists and Related Eclogites, Bellingham and Seattle, Waah. Boonsor, GSA, IE. H. Brown, Dept. of Geology, Western Washington Univ., Bellingham, WA 98225, or B. W. Evana, Dept. of Geological Sciences AJ-29, Univ. of Washington, Seattle, WA-98195.)
Sept. 7-10. AIFG Annual Meeting, Jackson Hole, Wyo. (Gene R. George, General Chairman, P.O. Box 2775, Casper, WY 82602; tel.: 307-205-9199.)

9199.)
Sept. 11—14. Distribution System Symposium, Birmingham, Ala. Sponsor, American Water Works. Association. (A.W.A., 8.066 West Quincy Ave., Denver. CO 80235; tel.: 503-794-7711.)
Sept. 12—14. National Weter, Well Association Soth Annual Convention and Exposition, St. Louis,

Meetings (cont. on p. 530)

Meetings (cont. from p. 529)

Mo. (NWWA, 500 West Wilson Bridge Rd., Wor-Illington, OH 13085.)
Sept. 12–16 International Water Supply Association Exhibition and Confecences, Brussels, Bellington

tun Extilation and Camiceenrei, or usses, pergum, (IWSA Secretaria), I Queen Anne's Gale, Londina SW 1987, United Kingdom.)

Sept. 12–16 International Symposium on Isotope Hydrology in Water Resources Development, (IAFA, P.4). Bue 100, Vienna International General Annual Communication

(IAFA, 1-1). For 100, Vienna International Gen-tre, A-1400, Vienna, Austria.) Sept. 13–14 [2th Annual Conference of the Illinois Department of Energy and Natural Resources on Illinois Climate: Trends, Impacts, and Issues, Ur-lana, Ill. (M. Maswell, Office of Conferences and Institutes, Univ. of Illinoic, Urbana, 1L 61801; Jeel.; 217-333-2881.)

Ict.: 217-333-288(1)
Sopt. 18-21
Fastern Scotion Annual Meeting, Mo-honk Monntain House, N.V. Sponsor, Seismokoji-ral Sudety of America. [Ellyn Schleringer-Miller or Noel Barstow, Lamont-Dohern Geological Ob-servatory, Palicades, NY 10964; Jel.: 914-359.
2900.)

Sept. 18-22 Brecciation and Mineralisation Incitadonal Conference, Colorado Speings, Colo. (Leanue Stone, Diesion of Caulinaing Education, Univ. of Nevarla-Rent, Rent, NV 89557; tel.:

Colley, Or reventa-Reine, Reine No. 1995, 1982.
702-781-40-16.)
Sept. 19-20 1-fab Biennial Conference Conference
on Ground Water. Sponsors, University of California Water Resources Center and California De-Sources Center, University of California, Bavis, CA 95616; tel.: 916-752-1544.)

CA 95616; rel.: 916-752- [544.)

Sept. 18-25 International Technical Conference on National Weather Service Real-Time Data Collection and Natural Faori Hazardi, Satramento, Calif. Spunsers, VMO, NOAA, Calif. Dept. of Water Resources. (R. J. C. Burnash, Calif. Nevada River Forecast Center, National Weather Service, Rasm Bill. 5416 Ninth Street, Sacramento, 4A 95814 or the Secretary-General, WMO, Case Postale No. 5, CH-1211 Geneva 20, Switz-Fand, Sept. 18-25 International Symmosium on the Geol.

Sept. 18-25 International Symposium on the Grob-logy of the Taurus Belt, Ankara, Turkey, Sponsor, Mineral Research and Exploration Inclining of Tarkey and Geological Stociety of Turkey, (Maden Tedkik ve Acama Enstitusů (MTA), Turus Jeolojisi

Ankary, Turkey.)

Sept. 21–25 Technical Symposium on Acid Rain Transport and Transformation Phenamental Borlington, V. (E. A. Cassell, School of Natural Resources, 93S Aiken Center, Univ. of Vermont, Burlington, V.T 18-105.]

Sept. 23–24 Models in Geomorphology, Ruffalo, N.V. Jalichael Waldenbeeg, Dept. of Geography, State Univ. of New York, Buffalo, NY 14240.)

Sept. 26–30 Second International Meeting on Statistical Climatology, Lisbum, Portugal. Spontoes, National Science Foundation, Office of Naval Resourch, Walco, CA. H. Murphy, Dept. of Annospheck Sciencee, Oregon State Univ., Carvallis, OR 97331.1

aphetic Sciencee, Oregini State Univ., Cia vanis, OR 97331.1
Sept. 3B-Oct. 1 ACU Pheific Northwest Regional Meeting, Bellingbam, Wash. (David E. Engelsresian, PNAGU, Dept. of Geology, Western Washington State Codlege, Bellingbam, WA 98225.1
October Second Iraqi Hydrological Conference, Spransor, IAFIS, (Dr. N. Al Anvari, Ministry of Irrigation, Bughdad, Iraq.)
Oct-Nov. 22nd Session of the UNESCO General Conference, (Sorin Dunificeum, Birceum, Division of Water Sciences, UNESCO, 7, place the Fruitcuo, 75700 Paris, France; tel. 331-577-1640 v6093.
Oct. 2-7 Penerser Conference on Prefaceour Officials, Colorado Springe, Colo. Sponsors, GSA and the International Geologic Correlation Programs, (Eric Barron, National Center for Atmospheric Research, P.O. 8tex 3000, Boulder, CO 80307.

grant. Effic Barron, National Center for Atmospheric Research, P.O. 8 ex 3000, Boulder, CO 80307.]

Oct. 3-7 Ghapman Coaference on Magnatic Reconnection, Los Alamos National Laboratory. Los Alamos, N.M. 1 Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 21009.)

Oct. 8-12 Meesting: Association of Earth Science Erliors, Houston, Tex. (Pamela Jone, Lamar and Plaustary Institute, 3303 NASA Road One, Houston, TX 77058; tel.: 713-486-2150.)

Oct. 8-13 19th Annual AWR A Conference and Symposium, San Amonio, Tex. (Kenneth D. Reid, Executive Director, AWRA, 5410 Coassenor Lane, Suire 220, Betheada, MD 20814.)

Oct. 9-15 Sixth International Symposium on Environmental Biogeochemistry, Santa Fe, N.M. (James A. Brierley, Bepartment of Biology, New Mexico Institute of Mining and Technology, Socorro, NSI 87801.]

Oct. 11-16 Second International Symposium on River Sedimentation, Nanjing, China, ID, Gyoreu, Nanjing Hydraulic Research Incidute, 223 Gangshou Road, Nanjing 210024, Peoplex Republic of China.]

Oct. 15-14 The Water Resources of Georgia and

Nanjung rydrabulc Research Inclinice, 223 Gangzhou Road, Nanjing 210024, Peoples Republic of China.]

Oct. 13–14 The Water Resources of Georgia and Adjacent Areas, Atlanta, Ga. Sponsors, Georgia Geologic Survey, Georgia Institute of Technology, Adama. CA 30332; Icl.: 401-894-3776; or Ram Arora, Georgia Geologic Survey, 19 M. L. King Jr., Dr., S.W., Atlanta, GA 30334; Icl.: 404-656-3214.)

Oct. 16–20 Fifth International Conference on Basement Tectonics, Cairo, Egypt. Sponsor, Deuver-based 8asement Tretonics Committee, Inc. (J. J. Gallagher, Ir., Cattes Services Co., Box 3908, Tulsa, Ok 74102, or S. Riad, Dept. of Geology, Univ. of Assiut, Assiut, Egypt.)

Univ. of Assiut, Assiut, Egypt. of Geology, Oct. 17-20 15th Meeting of the Division of Plane.

tary Sciences, American Astronomical Society, Ishaca, N.Y. [Sieven J. Ostro, Space Science Budding, Coencil Priv., Uhaca, N.Y. 11883.)

tary Sciences, American Astronomical Society, Ishaca, N.Y. (Steven J. Ostra, Space Science Budding, Coenell Pink, Ithaca, N.Y. (1853.)

Oct. 17–21 Technical Conference on Observation and Measurement of Amospheric Cambanianis, Vienua, Austria. Spansons, WMO. Intensitional Atomic Eneegy Agency, UNEP, and the Austrian Zemralanstali fur Memorologic and Geoglipsik. (WMO Secretariat, Auemica: CENV, Case postale no. 5, CH-1211 Geneva 20, Switzerland.)

Oct. 18–20 Fifth Conference on Hydronocleorology, Tulsa, Okla. (W.). Pupsley, Program Co-Chairman, Chief Hydrameteorology Division, Canadian Climate Carire, 4915 Inferin St., Dawnsview, Ont. M311 514 Ganadia; etc. 426-667-4817.

Oct. 18–20 International Lake and Reservoir Management Symposium, Knoxville, Tenn. Sponsor, North American Lake Management Soriety. [To aend aberasts, Lowell Klessig, Callege of Natural Resources, Univ. of Wisconsin, Sevents Polm, W54481; etc. 715-346-783. For additional Information, Wayne Poppe, TVA, 244-4Bl Building, Clustanoga, TN 37401; ed.: 015-761-7393.]

Oct. 18–20 Tri-Services Infrared Backgrounds Symposium, Burlington, Mass. Sponsor, Department of Defense. (R.E. Murphy, AFGLOPR, Hunstom AFB, MA 01731.)

Oct. 22–26 Seventh Ioternational Equarine Research Conference. Vigmia Beach, Va. Sponsor, Estatrine Research Federation. (John Kreauter, ERF Treasurer, Crane Aquaculture Facility, BG&E, P.O. Box 1475, Baltimoc, MD 21203.)

Oct. 23–28 Symposium on Neotectonics, Seismicity, and Geologic Hazard in the Caribbean and Venezuela, Caracas, Venezuela, Sponsor, INQUA Neotectonics Commission. (André M. Singer P. Depto. Ciencias de In Tierra, FONVISIS, Apagematodo Postal 1892, Caracas 1D1, Venezuela, telexical 26-153.)

Oct. 25–28 29th Annual Midwen Groundwater Conference, Champaign, Ill. Sponsor, Illinois State Water Survey, 1Ellis W. Sanderenn, Illinois State Water Survey, 605 E. Springfield Arenue, P.O. Box 5050, Statun A, Champaign, IL 61820–9050; tel.: 217-333-0235, or Philip C. Reed, Illinois State Geological Survey, 615 E. Peahody Drive, Champaign, IL 61820; tel.: 217-344-1481.1 Det. 31-Nov.2 Shunle Environment and Operations, Washington B.C. Sponsot, American Institute of Aeconautics and Astronautics. (AIAA. Meeting Dept., 1200 Avenue of the Americas. New York, NY 10019.4

New York, NY 10019.1

Oct. 31-Nov. 2 Sixth Oak Ridge National Laboratory Life Sciences Symposition, Knoxville. Tenn. Sponsors, U.S. Dept. of Energy, the National Science Foundation, the National Oceanic and Atmospheric Administration, the Electric Power Research Institute, and Gas Research Institute. (Debbie Shepherd, Oak Bidge National Laboratory, P.O. Boe X, Building 1505, Oak Ridge, TN 37830, tel.: 015-574-75021.
Oct. 31-Nov. 3 GSA Annual Meeting, Indianapolis, Ind. (J. M. Latulippe, Meetings Dept., GSA, P.O. 80x 9140, Boulder, CO 80301.)
Oct. 31-Nov. 4 American Institute of Chemical Engineers, Washington, D.C. 18, Peters, Givil Engineering, Purdue Unic., West Lafayette, IN 47907.]
Nov. 7-8 1-1dt Underwater Mining Justitute Meet-

A7907.]

Nov. 7-8 1-Idi Underwater Mining Institute Meeting, Madison, Wis. (J. R. Moore, Martine Science Institute, Univ. of Texas-Austin, 200 East 28½ St., Austin, TX 78705; tel.: 512-471-4816.)

Nov. 14-17 Seventh International Symposium on the Scientific Basis for Nuclear Waste Management, Boston, Mass. Sponsor, Materials Research Soriety. (Gary L. McVay, Materials Dept., Battelle Northwest Laboratories, P.O. Box 909, Richland, WA 99352; tel.: 509-375-3762.)

Nov. 15-18 Eighth Conference on Probability and Statistics in Atmospheric Sciences, Hot Springs, Ark. Sponsor, AMS. (R. W. Kats, Bept. of Atmospheric Sciences, Oregon State Univ., Carrallia, OR 97331-1

OR 97331.1

Nov. 16–18 Third Applied Climatology Conference, Hot Springt, Ark. Sponsors, Committee on Probability and Statistics and Applied Climate Committee of AMS. (Send all abstracts to Wayne M. Wendland, Illinois State Water Survey, P.O. M. Wendalid, Illinois State Water Strivey, P.O. Ilox 5050, Station A. Champaign, H. d1820.1 Dec. 8-3 International Cambreene: Goundwater and Man. Sydney, Australia, 1The Services Phylad., P.O. Box 1929, Canberra Chy, ACT 2001, Australia; jed.: 062-49-8015; jelex: AAG2200 (UNIHS-ACTS).)

Dec. 8-9 Second South East Asian Survey Conserved State Man. Sec. 8-10.

Dec. 5-9 Strond South East Asian Survey Congress, Hung Kong, Spoutter, Hong Kong Straigh of the Soyal Institution of Chartered Surveyors and Hong Kong Institution of Chartered Surveyors and Hong Kong Institute of Land Surveyors. ICongress Secretarial, Second South East Asian Survey Congress, 57 Wyndham Street, Ist Floor, Central, Hong Kong, 1

Dec. 5-10 AGU Pall Meeting, San Froncisco, Calif. (Meetings, AGU, 21000 Florida Ave., N.W., Washington, DC 20009.)

Dac. 5-16 Workshop on Pattern Recognition and Analysis of Seismirity, Trieste, Italy, (International Center for Theoretical Physics, P.O. Box 586, 1-3-4100 Trieste, Italy.)

Dec. 12-15 Confisence on Advances in Infiltration, Chicago, Ill. Spousars, American Society of Agricultural Engineers, AGU, (J. L. Nieber, Program Flatirman, Dept. of Agricultural Engineering, Texas A&M Univ., College Statinn, T.X. 77843.)

Dec. 18-17 Second Annual Meeting of the Works.

77843.]
Dec. 18~17 Second Annual Meeting of the Working Georp on Mediterraneau Ophiolites, Florence, Italy, (Giovanni B. Piccardo, Intrintu di Mineralogia, Petrographia e Geochimica-Università, da La Pira 4, 30121 Firenze, Italy.)

Jan. 9-13 Chapman Conference on Natural Variations in Carbon Dloxide and the Carbon Cycle, Tarpon Springs, Fla. (Meetings, AGU, 2000 Florida Ave., N.W., Washington, DC 20009.)

Jan. 11-14 National Meeting of the International Union of Radio Science (URSI), Boulder, Colo. Sponsor, U.S. National Committee of URSI. (T. E. Van Zandt, NOAAERL, REALS, 325 Broadway, Boulder, CO 80305; tel.: 303-197-3855.]

Jan. 16-20 Microware Signatures in Remote Sensing, URSI, Toulouse, France. Sponsors, Centre National d'Etude Spatiales, with the participation of URSI Commission F and the Centre d'Etude Spatiale das Rayonnements (CESR). (Technical program, Erwin Schanda, Universität Berne, Institute of Applied Physics, Sidlestrasse 5, 3012 8 emc, Switzerland or Richard K. Monre, Remote Sensing Laboratory, Univ. of Rantas Center for Research, Inc., 2291 Irving Hill Drive-Campus West, Lawrence, KS 68045. Registration, F. Cambou, Head, CESR, 9 Avenue du Colonel Ruche, B.P. 4346, 31B29 Toulouse-Cedex, France.;

Jan. 18-21 Penrose Conference on the Evolution of the Central Atlantic Ocean and its Coutinental Margins, Gkns, France. (J. Sougy, Lahoratoire de Géologie Dynamique, LA CNRS no. 132. Faculté des Sciences de Saint Jérôme, 13397, Marseille Cedex 13, France; Icl.: (91) 98 90 10, ext. 510.]

Jan. 23-27 Ocean 8elences Meeting, New Orleans, La. (John R. Apel, Assistant Director for Planning, Johns Hopkins Rd., Laurel, MID 20707.)

Jan. 28-Feb. 3 Conference on Planetary Plasina

20707.)
Jan. 28-Feb. 3 Conference on Planetary Plasma Environment, Vosemite, Callf. Sponsor, NASA. (J. H. Walte, NASA/Morshall Space Flight Center, tel.: 205-453-3037; or C. R. Clauer, Stanford Univ., tel.: 415-407-4691.]
Feb. 7-8 Subsurface Investigations Conference, Surface and 8 orehale Ceophysics, 3an Autonio, Terestreet.

Surface and 8 orehnle Ceophysics, San Antonio, Tex. Sponsor, National Winter Well Association. (NWWA, 500 W. Wilson 8 ridge Rd., Worthington, OH 13085; tel. 614-846-855.]
Feb. 9-14 International Symposium on Recent Crusual Movements of the Pacific Region, Wellington, New Zealand, Sponsor, Royal Society of New Zealand, (Secretary, H. M. Bibby, Geophysics Division, DSIR, P.O. 80x 1320, Wellington, New Zealand.)

March 19-24 Third International Symposiu March 19-24 Third International Symposium on Land Subsidence, Venice, Italy, Sponsor, LATS, (A. f. Johnson, Program Chairman, Third Inter-national Symposium on Land Subsidence, Wood-ward-Clyde Consultants, 7000 East Orchard Rd., inglewoorl, CO 80111.1 rch 19-27 Sixth Session of the International

Hydrological Program

March 22–29 Seventh International Symposium

on Equatorial Aeronomy (ISEA), Hong Kong,
Sponsors, B-SU Committee on Spane Research,

HCG, IAGA, IAMAP, and HRSL IS, Matsushna. Chairman, ISEA, High Altitude Observatory, NCAR, P.O. 80x 3000, Boulder, CO 80307; rel

303-494-6151.)
March 28-27 South-Central Section Alecting of the USA, Dallas TX. (Jean Landippe, Alectings Dept., GSA, Boulder, CO BROWL; tel.: 303-447-

2020]. Maych 28–30 International Semposium on Farth-quake Relief in Less Inclustrialized Areas, Zmitch, Switzerland, [Swiss National Committee for Larth-quake Engineering, SIA Postlach, CII-8009, Zni-rich, Switzerland.)

quake Engineering, SIA Pusibach, CII-8039, Zirrich, Switzerland.)

Apell Arctic Water Publishing Research: Applications of Science and Trechnology, Yellawkinte, N.W.T., Camada, (W.A. Ividgee, Hristor Values, Ltd., P.O. Box 3161, Halifac Smith Post Office, Nova Scotia 83] 3145, Camada.1

April (SCE/ASCE Cold Regions Engineering Spreadity Conference on Nurthern Resonate Development, Edmonton, Alberta, (Daniel W. Smith, Bept. of Civil Engineering, University of Alberta, Edmonton, Alberta (Daniel W. Smith, Bept. of Civil Engineering, University of Alberta, Edmonton, Alberta (Pariel W. Smith, Bept. of Civil Engineering, University of Alberta, Edmonton, Alberta Tief 207, Camada.)

April International Conference on Recent Advances in Mineral Science and Trechnology, Minnek (The Conference Secretary (1.25), Minnek (Private 8ag X50115, Ramburg, 2125 Smith Africa 1 April 3–8 International Conference on Meeting the Water Neede of the Southwear, Dallay, Tec. (Michael A. Callins, School of Engineering and Applied Science, Southern Methodisu University, Ballac, TX 75275; feb.: 214-692-3060.)

April 4–6 Juint North-Central Section and Southern

sity, Ballac, TX 75275; tel.; 211-692-3060.)

Apell 4-6 Juint North-Central Section and Southcast Sections Meeting of the GSA, Lexington, Ky,
(Jean Latulippe, Meetings Dept., GSA, Boulder,
CO 80301; tel.; 303-447-2020).

April 24-27 Pacific Conference on Marine Technology (PACON 84), Honolulu, Hawaii, Sponsor,
Manne Technology Society, (PACON 84, Center
for Engineering Research, Univ. of Hawaii at
Manon, Honolulu, H1 96822, tel.; 808-148-7538
or 7449.)

or 7449.) April 50–May 5 Suih Annual Technical Meeting: Environmental Integration Technology Today for a Quality Tomorrow, Orlando, Fla. Sponsor, Institute International Sciences, Hustitute for Environmental Sciences, 940 F. Northweet Hwy. Mount Prospect, IL (10)156; (ed.: 312-255-1501.)
May-June 12th International transpect on Irrigation and Drainage, Fort Collins, Cohe (ICID, 48
Nyaya Marg, Chanakvapuri, New Delhi 1 (10)12.

India.)

Mny 7–9 Third Symposium on Arctic Air Chemistry, Bownsview, Oni., Canada. II. A. Harrie, Almossopheric Environment Service, 1912 Dufferin St., Downsview, Ontario M311 57-1, Canada. tel.: 416-607-4785; nc K. A. Rahu, Graduate School of Oceanography, Unic. of Rhude Jehnaft, Narragansen, R1 02882–1197, ed.: 401-792-623-1.1

Mnw 14-18 AGO Spring Meeting, Cincinnati,

sell, RI 02882-1197, rel.: 401-792-6254.1
Mny 14-18 AGO Spring Meeting, Circinuali,
Ohio, (Meetings, AGU, 2000 Florida Are., N.W.,
Washington, DC 20009.1
May 20-25 International Symposium on Deep Oleservation and Sampling of the Continental Crust
Through Drilling, Tarrytawn, N. V. (Harry Raleigh, Directon, Lamout-Doberty Geological Oliservatory, Palisades, NV 10964; rel.: 911-336.
2900.)

2900.)

May 21–23 International Groundwater Symposium on Groundwater Resources Utilization and Contaminant Hydrogeology, Montreal, Canada. Sponsors, Catadian National Unique of the International Association of Hydrogeologists, and the Canadian Water Well Association. (A. Kolmt, Chairman, International Groundwater Symposium Montreal '84, Ministry of the Environment, 765 Broughton St., Vktoria, British Columbia, V8V 1X5, Canadia).

Mny 21–23 Symposium on Climate: History, Periodicity, and Predictability, New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Columbia Univ., New York, N. V. (Indue E. Sanders, Dept. of Geology, Ibernard Collinge, Collinge,

May 23-25 Fourth National Sympusium and Exposition on Aquifer Restoration and Granuel Water Monitoring, Colondors, Ohio, Spansor, National Water Well Association, (NWWA, 500 W. Wison Bridge Rd., Worthington, OH 12085; rel.; 614-846-9555.)

614-846-955.1
Mny 24-28 Symposium on the Illenty of Soil and Water Conservation, Columbia, Mo. Symposium on the Illenty of Soil and Water Conservation, Columbia, Mo. Symposium, Missouri, the Agricultural History Society, and the Soil Conservation Service of the U.S. Dept. of Agriculture, (Susan Flader, Dept. of History, Univ. of Missouri, Columbia, MO 65211, tel.: 514-882-2481 or 314-442-1058; are Dauglus Helms, Historian, Soil Causervation Service, P.O. Helms, Historian, Soil Cattuervation Service, P.O. Box 2890, Washington, DC 20013, tel.: 202-382-

May 28-June 212th International Congress on Irrigation and Drainage, Fort Collina, Cake, Spousor, U.S. Committee on Irrigation, Drainage, and Flood Control, (U.S. Committee on Irrigation, Drainage, and Flood Control, (P.O. Box 1832fi, Denver, CO 80215.]
May 28-June 1 Joint Meeting of the 11th Annual Meeting of the Canadian Geophysical Onion and the 18th Annual Congress of the Canadian Meteorological and Oceanographic Society, Halifax, Nova Scotia, Canada, 18. D. Smith or H. R. Jackson, Bedford Insulute of Oceanography, P.O. Box 1006, Dartmouth, Nova Scotia, Canada 82Y 4A2.)

Summer Summer Computer Simulation Conference, 8 oston, Mass. 3 ponsor, 3 uciety for Computer Simulation. (SCS, P.O. Box 2228, La Jollo, CA

control New Zealand. Sporsor, Royal Society of New Zealand. (Secretary, H. M. Bibby, Geophysics Zealand.)

Feb. 20-24 Chrpman Conference on Collisionless Shock Wavas in the Hollosphare, Napa, Chilf. (Meetings, AGO, 2000 Flortila Ave., N.W., Washinginn, DC 20009.)

Feb. 21-24 South East Asia Petroleum Exploration Society (SEAPEX) Meeting with Fifth Offshore Southeast Asia Conference and Exhibition (IOSEA), Singapore 0922; tel.: 397-8476; telex: Peb. 22-34 Ish Meeting, International Erosion Control Association, Denver, Cole. [International Erosion Control Erosion

Ivan Johnson, Wordbeard-Carle Consultant, 7000 k., Ordand Road, Friglewood, TO 2011, ed., 2021-27701.

June 25-27 Hock Mechanics in Protection and Productly Hy, 25th CAS, Symposium on Relagation, Landon, Hy, Sponsor, AGU, Chakel Dawding, Dept. of Livil Engineering, Northeat on Philic., Evanston, H. 60204; ed. 312-49. 7270.1

7270.1 June 25-27 Samposium of the Achierment of the International Magnetospheric Study Gu Austria. Spoteor, Screenific Committee on So-Terrestrial Physics of ICSU, J. G. Roedenso-physical Institute, Cnic. of Alaska, Farbada A 00701.1

90701.1 June 28-July 7 Symposium on Space Observata In Climate Studies, Graz, Austra Space, World Climate Program, IS, Rusenberg Sociate, LASPAR Commission A, NCAR, Books,

CO 80:007.1
Juno 26-28 International Symposium on Dep Structure of the Continental Great Result for Relicerion Scientology, Hincz, N.Y. Sponia, AGU, Minawia Bantzangi, Conference Cooling, International Geological Sciences, Cornel Em-litional, NY 14823; tel.: 607-250-6411 or Tel. 107-178.1

Hilliand, NY 14853; tel.; 607-250-641] or Tele.
1937-78.)
July 10-23 Symposium on Wave Stealing Includent Mixing, and Radin Probing of the Occasurator Mixing, and Radin Probing of the Occasurator Mixing, and Radin Probing of the Occasurator Mixing, and Palanciary Sciences. The Manual of Faith and Planetary Sciences. The Manual Chippins Conversity, Baltimore, MB 31215; Marting Language Englineering, Nan Francisco, Calif. Space Faithpunk Engineering, Nan Francisco, Calif. Space Faithpunk Engineering, Nan Francisco, Calif. Space Faithpunk Engineering, Science (CERT), ACU. (). Penalem, Challe-SWCEE, Hill 2023 Intelligent Highest Specialty Conference, Pagetaff, Acis. Speciasors, Geound Water George and Suclace Water Committee of the Implication and Drainage Division of the ASCE, Spaceima romact, Kenneth G. Renard, Souther the Irranian and Engineering Contention of the ASCE Spaceim Committee Committee on Climatic thanges and the Ocean and the Jacket Mixing Committee C

July 31-Aug. 2 Fourth International Symposius on Stochastic Hydraulics, Univ. of Illinos, (1) hand-Champaign, Spantors, Internalind aso-nion of Hydrantic Research and AGU, Ber C Ven, Wilson H. Tang, or Glenn E. Stor, Jegs-L Ciril Engineering, Univ. of Illinois, 208 N & mine St., Urland, H. G1801; tel. 217-533-656 333-1920i.)

July 31-August 3 Workshop on Fission Tradition, Trov. N.V. Sportsons, General Elemic Research and Development Laboratory, State Diversity of New York, at Albany, and Renselational Laboratory, State Diversity of New York, at Albany, and Renselations. Pulctechnic Inntinue, (Donald S. Miller, Department of Geology, Reusselaer Polytechnicles as Troy, NV 12181.)

Hent of Geology, Rensselaer Polytechnt 1982
Teat, NV 12181.1
Aug. 4–14 27th International Geological Cognitive at 1988. Sponsors, USSR National Committee for Leodogy, ICris, Organizing Comates of the 27th ICC, Institute of the Liboghez 22, Statemontenty, Moscow, 199180, ISSR Aug. 12–16 20th Ammad AWRA Conference of Symposium, Washington, D.C. A. Diez, Copt Engineers, Institute for Water Resource, Koption, 13–16 20th Ammad Water Resource, Koption, U.S. Ammy tamps of Engineers, Institute for Water Resource, Koption, Vashington, D. C. Spansor, AWRA Libertz, U.S. Amny tamps of Engineers, Institute for Water Resources Coffeen, Washington, D. C. Spansor, AWRA Libertz, U.S. Anny tamps of Engineers, Institute for Water Resources, Casey Bildg. For Behist VA 22000, 1et.: 292-325-6768.]
Aug. 21–29 International Radiation Symposium Station of IAMAP. (Compto Forces, Chaluman IRS '84, Diparnimento di Friex, Jun Inheritation, 101185 Rome, Italy; Telex: INFNRB 613255-1

IRS '841, Dipartimentor di Finica, Emi Piners taria, 101185 Rome, Italy; Telex: INFNRB 1673255.1

Sept. 3-7 Quadrennial Ozone Symposium Hibritisian of IAMAP, Commission of the Europea Communities, the Armlemy of Albers, and its WM19. (Thi istus S. Zerufuv, Clairman, Localoganizing Committee, Physics Depx., Campu Bal-181, Oniv. of Thecsalonid, Thessalonid, Green Sand repty of Information respies to C. D. Wishaw, Six telary, International Ozone Commission, Clairenation Laboratory, Oxford Unix, Fab. Risad, 15 fand, OM SPU, UK. Sept. 26-28. Seventh National Groundwater Quisity Symposium, Las Vegas, Nev. Spontor, Macal Vell Association. (NVWA, 500 ff. Machine Watchington, OH 43085; tel-308-804-91555.)

Oct. 31-19 Alpti Annual Meeting, Orlando, ft. (Buddey J. Timmons, General Chaliman, Timmons Associates, P.O. Box 50606, Jacksonik, Il 32290; tel: 004-245-1533.)

Oct. 31-Nov. 7. Reghmal Assembly of 1859L finited and India. (Mohan L. Gupta, Organica, Committee, 1859/Ef. Regional Assembly, Salon Geophysical Rescarata Institute, Hyderatod-80-007, India; telex: 155-478 NGRI IN; calie; clex. Nov. B. B. GSA Annual Meeting, Reno, Nev. Jon.

physics.) Nov. 5–B GSA Annual Meeting, Reno. Nev. yea Lattifique, GSA, P.O. Box 01-10, Boulder, CO htt301; tel.: 303-447-2020).

1985

January International Congress of the Intersitional Association of Hydrogeologists (IAH). Tucson, Artz. Sponsors, IAH, AGU. (E. S. Septson, Chairman of the Artangement Comiser, son, Chairman of the Artangement Comiser, Dept. of Hydrology and Water Resource, Care Dept. of Hydrology and Water Resource, Care of Earth Sciences, Univ. of Arizona, Tucson, Al 85721.)

March 10–18 American Congress on Surving and Mapping Nadonal Meeting, Washington, D.C. (Willard A. Kuncis, 4415 Jensen, P. Paris, VA 22032; jel.: 202-425-8700.)

May 27–31 AGO Spring Meeting, Salimot, M. (Meetings, AGO, 2000 Florida Are., N.W. Washington DC 20009.)

Summor Colloquium on Comparative Sudy a Magnetospheric Systems, France. (Dominiot I. Quéau and Bent Méolier-Pedersen, DASO, O. Quéau and Bent Méolier-Pedersen, DASO, O. Quéau and Bent Méolier-Pedersen, DASO, O. Summor Colloquium on Comparative Sudy a Magnetospheric Systems, France. (Dominiot I. Quéau and Bent Méolier-Pedersen, DASO, O. Quéau and Bent Méolier-Pedersen, DASO, O. Summor Colloquium on Comparative Sudy a Magnetospheric Systems, France. (Dominiot I. Quéau and Bent Méolier-Pedersen, DASO, O. Sources, Brussels International Conferênce (DASO), INTERNATIONAL CONTROL OF STATE (Paris, Paris, Paris,

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S. Exertic, C. J. Cithines, J. H. Bologna, and C. I.
Reter
Grant-based spectral line measurements of the 22.2
th wher vapor absospheric emission line are used to
inine the assospheric water vapor profile. The resulte
searchly indicate that the vairs vapor mains ratio is
injuncted in the line in the cape them is not to be
injuncted in the line in the same in the second of the 1980
fut whi obtained in this expectment, which indicated
the miletime of a promounced legar of water vapor mear
is to. The resolvate of this data contained is this
sport, which isolutes the sellection and remotes of
special baselines, results in marked commarking of the
mist made airling catio profile in the lever cosomoter, and the peek is much less pronounced. I Above 65
is the sistent sport as the lands is second of the resolute.
There has also been a large mount of variasilling observed in the state vapor profiles, aspecially
at the dry-to-day time scale. The water vapor rebroat here been used to estimate the vertical compoors of the upper second-poort and state the periton couffemiliary. This analysis has indicated atter the text. post of the upper mesephoric oddy allfueion couf-ficial I. This sandyole has indicated either that relied trasport the soules in the mesospheru ero prints to order of negotitude longer than previous tidit here shown, or that present understanding of latter important to controlling the vertical district live fairs wear to the memorphers is inoduquate, i. Grophys. Res., Gruon, Paper 161199

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Maj Mandels Rd, Ugatteville, Md. 29764], K. F. Kiesk,

A. Tirk; C. G. Mellemeyer and D. Gordon

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Exploration Geophysics

680 Reportic and electrical mathods
A DID CRUSTAL ELECTROMAGNETIC SOUNDING IN THE GEORGIA

Negaty unlishified layer in the ase floor were made using the acceptoy technique in several ereas in the nearthern indian Ocean. Older measurements were added to new measurements and regressions for mean added to new measurements and regressions for mean added to new measurements and regressions for mean and instanteneous velectly versus one-way fraesifies of sound are presented for the Centrol Beggal Fan, the Central Andaran See Basin, the Hicober Fan, and the Sunda Tranch. New dafe and regression equations are presented for the Farial March 15 Sunda Tranch. In Hergul-March 15 Sunda Tranch. In Hergul-March 15 Sunda Tranch. In Hergul-March 15 Sunda Tranch. Hergul-March 15 Sunda Tranch. Hergul-March 15 Sunda Tranch. Hergul-March 15 Sunda Tranch. Bergul-March 15 Sunda Tranch. Hergul-March 15 Sunda Tranch 15 Sunda Tranch 15 Sunda Tranch. 0.34 s⁻¹ to 0.8t s⁻¹ with on everage of 0.58 s⁻¹ The necr-surface velocity gradient in the Sueda Trench was 1.33 a", but was higher in the ndjecent, Lossil Miceber Fem |1.62 s⁻¹). in the surface of the Eengel Fem the valently gradient was lee in the upper fan [0.86 e-1), high in the econtral Lam |1.96 a⁻¹|, and again fower in the southern form (1.18 s⁻¹), which may support and imen-tation models activing for bypassing of the contral for and higher rates of econgniction on the southern

these two processes could be estimated thatefore at about 85 \(\) 100 T S/yr, 10cman/stmosphere exchange, gas-particle conversion, sulfur budget) J, Geophys. Res,, Creen, Paper 301133

Willon C. Noot, Harlan Labous Stations
Willon C. Noot, Harlan Labous and Alano F. Cartor and
Charles O. Koeling (Surjeps Institution of Guesnography,
University of California at San Diego, is Jolia,

J. Goophys. Res., Grano, Paper f00971

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IND Expert and electrical mathods

INDERT SECTIONAGERIC SOUNDING IN THE GEORGIA

INDERT SECTIONAGERIC SOUNDING IN THE GEORGIA

INDERT SECTIONAGERIC SOUNDING IN THE GEORGIA

I SUPPORT SCHOOL OF Applied and Engineering
Strikes, Cornell Enterprity, Ithach, RY 14853), A.

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District Soundings In the Georgio Piedront
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by the special case of a spherical source of difetation. For two-dimensional models a cylindrical
source of difetation produces no free-air gravity
escale, dip-ally familing produces no Souguer
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escale, dip-ally familing produces no Souguer
escale dip and open craths produce a Souguer escale
equal to that which would be produced had the
escale divinit set crack down elimined out without
deforming the solid. C two-disamional crack
litial with material of density equal to that of
the heat tock would produce on bouguer escale).

Jecham eg : [1991] bewe reported temporal
thanges in gravity, elevation, and ercal estrain
slong the San Cedess | suit (n southern California
such that the Bouguer assonity spage-oily romains
unchanged and the updifit-to-strain ratio is about
-108 km. Sevetal distocation socheoless ata
proposed that utilil these constraints, but these proposed that fulfill these constraints, but these sachesises appear to be tether contrived and are not regarded as satisfactory applanations.

[Gravity accessing, dislocation nources]. J. Gaopbys. Pes., Red, Paper 381218

J. Geophys. Res., Sad, Paper f81251

Geochemistry

SULTUR CYCLE

B.C. NGUYEN (Contra des Yalbies Radioscrivités, CRES/CEA, 91190 Gif-sur-Yvates, França), CRES/CEA, 91190 Gif-gur-Yvette, France),
B. Bonseng and C. Gasder.
The background atmospheric 50; concentration above the sea surface has been satebilehed at 0.1 x 10-6 g/m² 135 pptv). Several hypotheses to suplain the origin of 50; about the ocean far from continental sources have bren distursed. We have shown that the source have bren distursed. We have shown that the source likely hypothesis is the bloganic production of reduced organic sulfur compounds in the ocean. The most obvious example is dissativisualfide (849; with sessurer concentration varying horseen 10 and 50 x 10-9 g/l. DNS subsequently diffuses joto the atmosphera, whato it has been measured at very low concentrations tending from 0.5 to 60 x 10-9 g/m² 10.2 to 29 pptv!. We satingue that a mean lifetime of 11 minutes could be a lower lifetime of 11 minutes We astimate that a mean lifetime of 11 minutes could be a lower limit for RMS in the marine atmosphere, diological activity has been above to influence the production of BMS; the richer the biological activity for stample in a convergence area), the higher the concentration of BMS. DMS and other reduced tempounds such as CM388 and CRASSCH; are spitted into the elmosphers en oxidized harm by complex mechanisms which are photochemically induced. That leads to 50; forus tion and subsequently to sulfate, A biological influence has also been determined on atmospher 50; concentrations. The flux of sulfur by this process : biological activity - organic suffi-des - SU₂ - SU₂ is ontimeted to be 44:13 x 10⁴ tons of sulfur per year. This biogenic produc-tion is of the same order of magnitude as acrosspheric sulfur production by sea spray, which is about 44 x 100 T S/yr. The occasule production by

1410 Chemistry of Lie accomplete Stabunain, Latingolinal, and Sectian Variations if The Accompany and Isologic Patios of Atmosphiraic Cambon Bloking I. Results from Land Stations

Charles O. Koeling (S.ripps institution of Oceanography, University of California \$4.093)

between Marri, 1977 and February, 1984, 517 assplas of it were collected in 5 liter sham fleaks at four attutions in the morthurn hemisphere near the Facilic ocean and ar the Bouth Pole. First the Cog concentration of each supple was determined by numdisparaige interested gas analysis, and than the 12/12c and 10/10c ratios of the cryogenic extracted Cog were determined with a rripis collector mass spectromater. For each station the accurate rand assessment variation in 12/12c could be been carabilished as a function in 12/12c ratio have been carabilished as a function in 12/12c ratio have been carabilished as a function in 1002 concentration. The assessmelly adjusted 10/12c ratio is yound to have decreased at a rate of about .02°/... per pps increased by lossil tust ronduction in the concentration, and to vary with laritude an aspected if COg la helms released by lossil tust ronduction in the northern immisphers and free ocuses water once the squarer. At the three sorchermost stations (is joil as 12/12c carlo in 12/12c carlo in 12/12c accomplated to the South Resident Cog vith the carbon of tempshetic COg vith the carbon

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(IOPARSI). The cacle ¹⁸ga⁷Se worled appracisely for
different shalis, indicating strong depandence as local
conditions. However, the lowest cacle was measured in
e Pielarvee shall from Italy, consistant eith fix aga
of 2.5 to 1 million yeats.
J. Googhys. Res., Creem, Paper 36105

Geodesy and Gravity

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Geomagnetism and Paleomagnetism

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variation, inomalies, time variations J. Geophys. Ess., Esd, Vepar 381063

250 Paleomagnalina
TABOLATURES OFTENDINED FROM PALROMAGNETIC DATA
FARMI VERTICAL ORDES
A. COR (Dapt. of Geophysics, Stanford University,
Stanford, CA GLOS), S. G. Gordon
Most of the paleomagnatic data svalishfs from
Most of the paleomagnatic from the basic
Paleomagnatic data to he snalyzed From crustal
Handks rhat have rounced by rarying smounts
about vertical mast are a set of paleolocitations.
A new method is proposed for determining the
Paleotolectitude of a sampling efter and the associmath confidence limits. Paleomagnatic Sanifamathous are Frat convected to paleocolectitudes
and everaged to produce a vesus colectique.
After showing that this mean is bland, we duties
as paleocolectitude merrection to remove the bias,
using a model for geomagnatic sacutary vaciation
hand on the isoticid dapendame of setules
vaciation during the past 5 million years. After
testing the validity of the south by applying it
to paleomagnatic data free Qualcemary lavas for
which both inefinations and dealigation are known,
we saply the acthod to inclination—only paleomagnatic data from Suite Samonat, the most
complate data from Suite Samonat, the most
complate data from Palefic plate to othalic for
such atta as unbisted dans delifing after. The method
is then applied to paleomagnatic data from
cach atta as unbisted dans delifical pire. The method
is than applied to paleomagnatic data
for confidence limits. These paleocolactivides

[Internal of the paleon of the paleon of the paleon of the paleon.] DEUF eless for the Pacific plate to obtain for each mits an unbitted span planonishtude and fix confidence limits. There paleocolaticides and confidence limits ere then each as input for a issat squares smajurals to obtain Errly and issue fortaxenous pales for the Patific plate and OS parchai confidence limits for chase belase it is shown that the sentes of individual after halsociaticides about the heat lic sold fic consistent with the confidence limits at each atto as determined by the new method of analysis. (Paleomagnative, plate tectoalca; paleomagnative pulse, Patific plate).

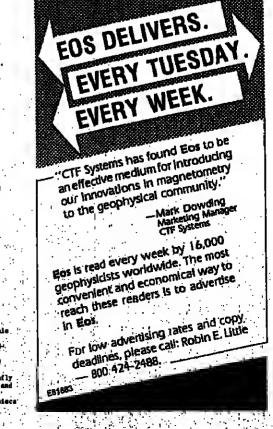
Rev. Goophys. Spane Phys., Paper 181307

2390 instruments and Trobniques (Segrugation restale cock origination)
CRITICAL EVALUATION OF SEGREGATION VESICLES IN MITHICRAM SIDES SASALTA AS A BOCK ORIGITATION TOOL
M.A. Van Vagoner Department of Poology; Delhine is
Notiversity, Weitler, Nove Scotic 538-315)
Segregation valuing to six Eloir benetic generally
are sphecical in shape, Q.1 to 0.1 we in dismorar, and
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abilized Yeardiff, manner, The residue prespublic outcom
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sufficient to maintais the ubaye of the weatcle but before item crystaflization, and flows to the bottom of the weatcle before solidity(og. The orientation of the menicus can, therefore, be used as as indicator of the cooling orientation of the roch. Results of scatterior item of the cooling orientation of the roch as a pive oriental by megacupic gapparal features indecate that the unafactures in segregation wesicles of a given orch sample are preferentially oriented about the entities gravity field as indicated by the togestopic features. In all cases there is consistency of segregation wesicles and negacopic orientations. As welf, the distributions of magnetic inclinations of rocks oriented by used to engage the content drodge and submorehies samples for palsonages to plain the distributions of total orient drodge and submorehies samples for palsonages to painty scales and reduction of total recovered in drill cores which have a known, toplace vertical oriented.

THE THEMAL BEHAVIOR OF AN IDEALIADD ACCISED THEMAL ENERGY STORAGE SYSTEM
O. Given (Cavil Empineering Opportunity, Auburn
University, Auburn, Alabama, 16849), J. G. Neiville, and T. J. Holz
Chalylical oxpressions are derived for the temperature classified in the tangent energy lates, saling into account the hear exchange at the ground surface and the limits thichness of the everlying layer abuse the acount the hear exchange at the ground surface and the limits thichness of the everlying layer abuse the scene temperature may be used to obtain rough earlmans of First-cycle successful expressions for the mean temperature may be used to obtain rough earlmans of First-cycle successful expressions for preliminary evaluations of shellow confined or unconficed ATES systems. The results, which are peasanted in mondimensional plots, indicate that surface hear exchange may have a significant influence on the thermal behavior of aballow ATES systems. Thus, it is suggested that the effects of surface heat oxyhoge should be considered carefully and included in the detailed analyses of such ATES systems. [Aquiler thermal sergy stolage, surface heat exchange)
Matur Canode, News. Paper 180402

Ilió Cromdwerer AB FFICIENT TECRNIQUE YOR MODELING TRANSPORT IN FIRITURED PORGUS MEDIA 1. SYCLIOS DECAY CRAIS TRANSFORY Peter S. Huyakorn, Serry R. iesrer, James W. Mercer (Godzams, lac., F.O. hor 2510, Beston, Va 24090) A finils efeacet modal (s presented for almulacion of muclide dacay chelu transport in a metucally fractured porous madium system. The model is capable of representing the physical system using a dualporousity approach, a facrete-fracture approach, or a combinarion of the physical system using a dualporousity approach, a discrete-fracture approach, or a combinarion of the process and hydrodynamic disparation in the present execute simulraneous diffusion in the porous martix and chain teactions of solute approach can be taken into account eiguiraneously. An efficient finite element solution technique, a parial discretizations and asimtions of systems of sights and capacides of sights and concentration value in fracture and porous martix domains can be performed esperataly. The grammet finite element model has been varified against anafytical solutions. Two rest problems invoicing transport of a chafu of three components in uniforcured and fractured purcous wells are presented to demonstrate the accuracy and stificiancy of the proposed finite element technique. Besults indicate that the present summerical model is capable of producing good predictions of beautifronge curvee oaing relatively capace spacial and Comporal



in State An



discretizations. A sajot edventage of the present transport model over pravines transport model over pravines transport model over pravines transport model as shat the latter see based an a numerical approach that employs overall discretization and significances colusted of the select set of algebraic oquations for concentration valves in the fratture and prome maters binch domaines. Set an epproach by the description of the sector of sector of the sector of t

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JHE Layesactfon of LAKES WITE VARIABLY-SATURAYED
PROCUS RDIA
T. C. Sinter(d.S. Geoisgical Survey, VSS, J.d. Sex
JJA66, KS JIJ, OFC, Denwar, CO SONI)

Humerical eleniation of variably saturated porous
media indicates tolat geomi-water technigs le variable
in time and space, depending on the thistness of the
uneaterated sons through which infiltrating water must
move. The seasting complex, transitor, ground-water
liuw seatens have significant legact on contiguous
surface water, in very garmeable media, small, local,
classé, ground-water flow systems can develop and
dissipate within a few weeks to seatral months after
major rescharge. These have a direct effect on
contiguous surface water by alternately causing
sampage to med sayange from the muticae water. The
ccassical matura of these flow systems indicate
wasseals af the direction of ground-water liew may be
caeman. In less perceable media, the seas campies
ilow systems may occur, but the time for ducalepuant
and dissipation is much greater. For example, 1s is
conceivable that smalf, local liew systems may scale
for many most be or years as a reaution in each
systems are more arable, and she silent on omntiguous
aurface water stee is more etable. The lindings of
this study indicare that wails and ground-reate
quality sampting sites need so be carefully incated to
accarately define water-table snotjayaxina, groundvater retherga, direction of accapage through the beds
of carface-water badles, and one less geochemical
processas related to ctanging sirections of groundwater steherga, direction of accapage through the beds
of carface-water badles, and one less geochemical
processas related to consigning sirections of groundwater steherga, direction of accapage through the beds
of carface-water badles, and one gets geochemical
water stehes and direction of accapage through the beds
of carface-water badles, and one few capages through the beds
of carface-water badles, and one few capages. Water Sceour. Rea., Paper 3W1154

POSSERVE EFFECTS OF BROSICUAL CHANGES OF THE TUPOGRAPHIC NELLEY OU POER FRESSURE AT DEPTH

J. Toch (Gooingy Department, University of Alberts, Education, Alberts, Tochis, Cannada), E.F. Hiller

Formation-livid pressures are said to be amomation of ubnormal if they differ from hydrotextic for the dapth considered. Explements of the origin and maintenance of amomatics acidem two dates the possibility of delayed adjustment of absurface pore-pressure to enceional modifications of the transfer to explement and difference of a the transfer of authorization and first the source pore-pressure to enceional modifications of the transfer in the source pore-pressure to pushif for submarial erosion to generate pore-pressure; though a series of the section of the transfer in teal facts in all conditions. Conversely, pessaures may survice thanges in the topography and be in a transfer in teal facts in all the sections of years the supporting amomations at the time of abservation. According to casculations for the Med Earth engine in Alberta, Janude, pressed against a supervise in the Devocian immediately above the Pressure for the Med Earth engine in alberta, Janude, pressed against a pressure in the Bevocian immediately above the Pressure to be the submediate process of the subcribed pressure of the subcribed and the submediately and the support of the subcribed pressure in the submediately conditions exacted by the evoluting now to new boundary conditions exacted by the evoluting now to new boundary conditions exacted by the evoluting the set 100 thousand reast low pressure reduction of the subcribed pressure to survive to date as slouly decaying transient pressure reduction of the subcribed pressure reduction of process of the goologic pont. In view of the possible section of hadroschoust radioactive wester lead at groundwater reductive wester lead at groundwater reductions and according industring of various geologic essess.

One passing related to deep besin bydralpsy, inclading trajication and according to the subcribed Water Sconur, Ses., Paper 'hviloh

3160 Butoff and aire and for TLOW THROUGH CHRIST CHARLES NELS. V.E. District (Department of Geology and Geophysics, University of California, Barkeley, California 94720), M.K. District (Department of Geology and Geophysics, University of California, Bardery, California, 19720), and 3, pages Smith and thoography that does not vary in the does not not not vary in the does not vary in the d

cutaide or concave bank throughout the flow depth over the upstream, shallow part of the point bar and an out-ward component of boundary wheer stress in this region. The channel nuesature induced inherd component of boun-dart shear stress consequently is confined to 20 or 305 of the channel width at the pool. Outward transfer of momentum over the point ber, as manifested by a rapid erossing of the high valooity core from the inside bank in the outside one, contributes to an enhanced decrease in boundary shear stream slong the convex side of the stress as the top of the bar is approached. Forces aris-ing from topographically-induced spatial scoelarations are of the same order of sugnitude as the downstream boundary shear stream she water surface slope force com-

Vater Assour, Res, Taper 341080

3190 Tetbelquee SONE ALGORITHMS FOR YARAKRYER SPETMAYION IN WATER STORE ALGORITHMS FOR YARREYER STERMYION IN WATER RESOURCES SYSTEMS

O. Senitogia (Mechanical Engineering Separtment, Louisisme State Uniteralty, Onton Rouge, LA 70803)

Enel-time State Uniteralty, Onton Rouge, LA 70803)

Enel-time algorithms for the estimation of the unhard model patemeters of some ester resources statem are descloped. The algorithms are of reservate form and can be used for on-lies identification purposes. Spealinally, proportional and proportional plus integed type Algorithms are derived by applying Lympanow's stability chances. This approach gustantess the asymptotic convergence of the Augorithm in the space of unknown parameters. The fields element nethod in
used to discertise the spatial doesie of the systems considered. The algorithms do not esquire prior knowledge of the superior knowledge of the superior knowledge of the superior industrial convertion—diffusion squarton and hurgars' equation.

J199 Miscotlanense (Real-time Flond forecasting) A STOCRASTIC-DYNAMIS HOSEL FOR MEAL-TIME FLOOD FORECASTING B.C.d. (Buw. W.S. WATT (Dopertness of Sivil

FORKCASTINU
S.C.A. GAW, W.S. WATT (Department of Sivil
Engineering, Queen's University, Singaton, datario,
Canada, Hi. 180), and B.C. Watta
A stochastir-deparade ondel for real-time lioud
lorecasting was developed saing Bor-lenkins modelling
tethelique. The purpose of the forecasting system le
to forecast flood lesels of the Saint John Siesz at
Yesdericton, Faw Bronsvith. The model consists of two
submodels: as upsieses model used to fraccast the
handpond lawel at the Mactaques Dam sed a downstreen
model is lorecast the water lawel at Fredericten,
inputs to the epstem are ascorded values of two water
lesel at East Plorenceville, the handpond lawel and
gate position at Eastequer, and the sacra lawel at
Fredericton. The model was calibrated for the spring
flonds of 1973, 1974, 1977 and 1978, and its
usenfulness was serified for the 1979 ilood. The
lorecasting results indicated that the
stochastic-dynasic model produces reseaschil accurate
forecasts for lead times up to two days. These
entraceasts were then compated to these from the
cellsting forecasting system, and wate found to be as
reliable as these from the extacting system.
(Real-time, Ylood Correcasting, Box-Jenkins models).
Water Emmour. Res., Saper JNO4466

Meteorology

IVICECOTOLOGY

1710 Deusdary layer structures and processes
MOOTELEC THE GLORIAL DEPSHDENCE OF THE OFFICAL
REFFACTIVE HEAK STRUCTURE PARAMETER

6. S. Kushel (New Meelen Cepartment of Agriculture, inse
Cruces, New Resico 280071; S. L. Whiters

A model which simulates the diwral dependence of the
aptitude refrestive index structure parents or which the
atmosphesis boundary layer is constanted by onlying an
onergi balanca equation int the ground surface
temperature. This embution yields nexises linear oil
sensible and latent best. Empirical relationships are
Chen need to estaulate the arrecture persenter. Model
results compare laworship with date obtained at a desect
lavarion. In particular, the model is very accurate in
almalating the structure persenter adequately. Rowwes, shourt-term
instructure parameter adequately. Newwes, shourt-term
instructure parameter adequately the conventions are simulated donitatively but one
quonticatively. This is due to the allects of darings
fleas and gravity wass on nighttile rubulence
atmetors. A sensitirity seafysis infinates that the
structure yerameter is particularly seafitive to the of
pant, wind speed, the product of enil best capacity sed
acil denaity, and enil onicture tonient. This ondel is
applicable own relatively flat surfaces with little or
no segetation. (Modeling, boondary layer, turbalence).
J. Geophys. Eas., Creen, Vaper 201176

1713 Chemical composition and chemical interactions (Monoturpane Nydrogarbone) MEASURDORN OF MOMOTERPENE HYDROCARBONE AT NIVOY SIDES, COLUMNO.

(Monoterpass Bydrocarbons)

REASURDERY OF MONOTERPONE HYDROCARRONS AT NIMOT SIDES, COLORADO

J. M. Boberts (MOAA/ERL Auronomy isb, M/s/ALO, Boulder, Colorado, Solol), 7. C. Febracifaid, 6. L. Albelitas, and S. E. Sizvers

Hassurfments of abnospheria monaterpass bydrocarbons were sade at a sire io the Colorado nountains. The measurfments were undertaken to examine the influence of the compounds on the photorhamistry ni ibn croposphere. A sampling tembologue was developed natus Tanac CC pursus polymar with analysis by capillary gas chrostagraphy using lians ionizarion and mass spectrocartic detection. Fosition identification of sis monoterpass bydrocarbons, n-planes, carphanes, B-planes, myromes, A-3-carens, and d-limenes was abtained, as well as tonterive iometification of orthujase and B-phallendeso. A definite assumoi trans was unident in the sureage was nonoterpass sixing ration. The summerim surrange was 0.30 ppbv for the sum ni the five major idearified monoterpass, d-pinons, B-planes, A-3-carens, cambbons, and d-limenes, with a high dayres of omnatancy in tralatics wetfor af such throughout the summer months. Two voctarties assessments gare mixing various below the detention limits (9.60) pbc of an individual compound). Simultaneous massescenants of compa, NO, NO, and somoterpass phytocarthons ellowed sammancion of the enstribution al monterpass phatoonidation to dome production. Eased on veperied modeling stadies, oncortapens were actimated to be a small source af oscas, insufficient to account for the velexies below this amplied attains to dome production. The company of the production, production, of the case, insufficient to account for the velexies and several at this amplied attains, oncortapens production.

3713 Chemical composition and chemical interactions 3713 Chemical composition and chemical interactions
THE COMPOSITIO: OF WESTERM ATLANTIC
PRECIPIYATION USING SMIPCOARD COLLECTORS
Joseon N. Galloway (Department of Entromment)
Sciences, University of Virginia, Charlotfasville,
Yinginia 22903), Anthony M. Knap Yhomas M. Church
Ysthniques hare been developed for the collection of rate on board ships. Chamirel and
roiterologiral omelysis of rais creats shows that
roin can be collected lear sejor ions on board ships
is consisteation from maner by using roilecteds
on the wiedward side of the ship. The results sion
support the conclusion of Jichella si of, 119921
that rais associeted with North American sir reseas
hee clowaind levels of SO₄, NO₅ and H⁵, while
rain associeted with sector Affects are masses
hee clowaind levels of SO₄, NO₅ and H⁵, while
rain associeted with sector Affects are masses
hee clowaind levels of SO₄, NO₅ and H⁵, while
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hee clowaind levels of SO₄, NO₅ and H⁵, while
rain associeted with sector Affects are masses
here also and the sector of the control of

Galdation os the only updated for HCHA. In that mid Atlancic diurnal vortations of the HCHA mid Atlancic diurnal vortations of the HCHA miding racio showing what maxima duting the sarly afternoom were occamionally observed. These relations may be attributed to the diurnal behaviour of the photochemical and physical processes which determine the midling rather of HCSO dwring stable wenther conditions. The results are discussed with regard to the currently accepted theory of the photochemistry of HCHO in the clean troposphere. If appears the trop the died HCHA incention through Hydrocarbon photocardation in the background was incompared to obtain a second from model coefficiently high NO concentrations. (Trace gas, online troposphere, ampling, latitudinal profilet.

J. Gophys. Res., Crem., Paper 101205

STORY ANTONE PULSES IS LIGHT AND ELECTRIC FIELD FROM STEPPE LANDERS HEART SCOUND LEVEL.

W. H. Besselsy (Dept. of Elec. Engr., Univ. of Ploride, Gainseville, Finish, 12611), S. A. Wann, O. M. Jerden, S. Genseb

During the summer of 1902, we used a colfinated nuarrow silt and photomultiplier tube in conjunction with a broadband electric-field system to study light and electric-field system to study light and electric-field pulses from about 20 m, we abserved correfeted sequences of fight and electric-field pulses from enctions of channel about 2 km, we abserved correfeted sequences of fight and electric-field pulses from enctions of channel about 12 saters long and shout 00 maters shows ground for 50 to 100 us print to the ifrat return strokes. These size intervels included sli the leader lighs pulses that were at least nine distinct light pulses. Sometimes these were measurable alectric-field pulses. Sometimes these were measurable alectric-field pulses preceding the first light pulse. Seely nr faterwoodlate light pulses upes the searm stroke. We interpret these abservations as the result of leader steps pearing through the field of rise of the elit. Seek light and electric-field pulses occurred at latervals of 3 to 20 us, had 10% to 90% rintimes of 0.3 to 0.9 us, and had full widths as half markers of 0.3 to 0.9 us, and bad full widths as half markers of 0.3 to 0.9 us, and bad full widths as half markers of 0.3 to 0.9 us, and bad full widths as half markers of 0.3 to 0.9 us, and bad full widths as half markers of 0.3 to 0.9 us, and bad full widths as half markers of 0.3 to 0.9 us, and bad full widths as half markers of 0.3 to 0.9 us, and bad full widths as half markers of 0.5 to 0.9 us, and bad full widths as half markers of 0.5 to 0.9 us, and bad full widths as half markers of 0.5 to 0.9 us, and bad full widths as half markers of 0.5 to 0.9 us, and bad full widths as half markers of 0.5 to 0.9 us, and bad full widths as half markers of 0.5 to 0.9 us, and bad full widths as half markers of 0.5 to 0.9 us, and b

J. Geophya, Baa., Cesen, Yapon 301141

1740 General circulation
MODIFICATION OF STRAIGSPHERIC SIRCHAFION BY TRACS
CONSTITUENT CHANGES:

7. J. Dunkerton (Physical Dynamics, inc., P. O. Box
3027, Esilevus, W. 98009)
The effect on the queel-bleenial meriliation of
disbatic heating due to volcenic accessis is investigated. A disbatic vertical velocity of order
.2 km sq. 1. corresponding me a incalled troplesi
beating wre of mades i. C/day, her as affect on the
QBO similar to that observed in 1963-1908. Easterly
chear romes arm roletiesly toid at the equator; their
doncent is ratarded by the disbatic circularion.
Whee all ather facture are assumed constant, the
dynamical link between Agung and the QSD requires
troplesi confinement of the marned closel and a rediactive heating rate of the rotest order of mignitude.
There is evidence that these requirements only here been
mat at least in the first two year lailouding the Agung
accessi thend in 1963-1965 is seen to be dynamical as
wall as charmodynamical, seculting in an anomalousity
long QBO period.
J. Geophys. Res., Creen, Papar 351232

1799 General (Atmospheric managements)
THE ATMOSPHERIC LIFSTON EXPERIEST, VIT RESULYS FOS
CCL1 based ON THRES YARAS OF DAYA
P.d. Signouds (Genchemistry Department, University of
Stistal, Stistol, O.K.), Y.N. Alges, C.A. Cacdellon,
A.J. Crwalard, d.M. Camould, S.C. ison, J.S. toroloch,
O.O. Prinn, and A.A. Rammason
Measurements all the atmosphesis concentration al CCl1
by electron capture-ges obtomatography are reported for
flee resets monitoring stations for the parind July
1975-Juna 1981. Sarismates of CCl2 estainse to the
atmosphera iron known industrial sources are scapared
with the measured trends sed the debaluar values all the
observed concentrations. The areange global
concentration at CCl4 to the lower tropasphera iron
July 1975-Juna 1981 was 110 pert and it was increasing
at 1.1 pptv/year over the period. The glabelly
arranged atmospheria idiation of CCl4 estculated seing
ac aptimal estimation terhalque and a 9-box model of
the atmosphere was 32 years.
J. Geophye, Res., Orean, Paper 3C1149

Mineralogy, Petrology, and Crystal Chemistry

4210 Crystal Chemisiry
QUARTITATIVE STUDY OF AI-SI ORDERING IN AN OSTHDOLASE
FELDSPAR USING AN AMAITICAL TRANSHISSION FLECTSON
MICROSCOPE
J. Tofté (Department of Physiss, Arizons Staid
University, Temps, Arizons, 05287), Peter R. Gusock
(Departments of Geology and Chemistry)
For certain crystal orientations and diffraction
ronditions, elactron-indused charasteristis k-ray
emission produces anomatous intensities can be used to
elactron channeling. These intensities can be used to
determine divectly the chemical compositions of specific
crystallographic sites within individual crystals. We
have used this channeling method to determine the Ai-3i
ordering in gas orthoclas from Ampandramdave
Hadegeacur. We find that 71 steody percent of the Ai
occupies the II site, in agvernent with the raises
derived from stendard x-vey powder diffraction data.
An. Hin., 88, 9-10

GUMINITATIVE STUDY OF AL-SI ORDERUMS IN AN OFFIDCLASE FELDRAR USENG AM ANALYTICAL TRANSHISSION FIELDRAN USENG AM ANALYTICAL TRANSHISSION FIELDRAN USENG AM ANALYTICAL TRANSHISSION FIELDRAN USENG ANALYTICAL TRANSHISSION FIELDRAN THE STUDY OF THE STUDY OF

A REVIEW OF THE THEOGRAPHYS-SHREITY FRORING IMPLICATIONS TO THE HINERADOT OF RARIST MANING MODBLES.

RAGET G. Gures (Department of Earth and Plansley, Sciences, Manzachusette Institute of Tephology, Cambridge, Manzachusette and Live of Tephology, Cambridge, Manzachusette and Live of Tephology, Cambridge, Manzachusette and Live, Manzachusette of the Departer Phase slein it to be the tephology of the Departer of Departer

Oceanography

4703 Boundary is ar and Eschange Frozense
SEA SURFACE EEGERATURE PATTERES AND A15-SE FURTY THE GERMAN SIGHT BURNEY RAISER 1979, PARS 1
Y. O. Latearus (Department of Atmospheric beleace, University of Vashington, Beattle, Vashington, Hill,
A. Pidea, F. Beuse and V. Aman
An analysis was nade of theorety sensed sea raise temperatures (5571 obtained from aircesit of mulliss and of data iron hydrological survays modeled in Carman Sight during the Harins Senots Seasing Inchment in the North Sea, August 15 to Septembr 15, 199
The double front ensuefated with frashwars and miching along the 10 a bottom contout at the northwars season to the subsarins gfacial valley of the His immeds of the most praninant feature.

Alte-sea (fures at heat and momentur was computed using personners) and heat and momentur was computed using personners and heat of the literia for the first first of the form is not a wident at the surface date the wind attrace le greater than about 0.5 Set? Is the autmost of 1979 these contained were also associated the weak heating or with o mer ronting of the set. Evil particular of weaker which enterer and attong soft battle as shallow thermoeline develops which tends as lefus the frontal rold water from the farmines and the frontal rold water from the farmines and the first and the curront shear as the irontal sons were rishing the surface addition of deaning and on the surface distributions of deaning and on the surface distributions of deaning and on the surface described front).

J. Goophyn. Ren., Grosa, Japan 20151

J. Goophra. Ren., Greed, Yapar 301181

4713 Circulation
AN EXAMPLE OF MITIOROLOGICAL EFFECTS ON DE ANOUS D'
CTRE
P. J. Ource [Navel Ocean Research and Development
Activity, Kode 440 MSTL, MS 39529], T. M. tinder
Following a peried of weel winds, an AST (An
deployable Expendable Mathythermograph turney of 134
1980 showed the Alboran Jos Syre Sterry present NT;
depth but not at the surface. Winds on S and filler
from the wast e '13 m/soc, and both AST texpendar
distributions and satollite images reliected on file
1980 showed the gyre rieerly dominating the texpenda
structure both at 100 m and vi the surface. The distristructure bear and 100 e temperature patient of
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bothoon into seriate and 100 e temperature patient of
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pretting setellite imagery let he Alboran Sal. Finistry
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based upon satellite imagery detail or represent in Vil
structure should be reviewed.
The chonge in the shallow texperature distributed
in 0 duty is apposite to what sees investigate the
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A799 General Ocaanography
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FITTLING OF SATELLITE AND IN-SITE OCEN SENSO
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J. Gaphya, Res. "Orand, Paper 301183

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the coling of a hydrotherus system: 1] Stage 1.
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increased, the final result being an Fe-chiarita
discussed the final result being an Fe-chiarita
context control at low temperatures icf00°C) after
this circulation cased.

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shorts and the hydrotherus Huid, considerants can
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forming on the final composition responsible for
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dring Eage 2 alteration are on much as 3 times that
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Particles and Fields-Interplanetary Space

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UNITY MARKHIC FIELD AS A RADIATOR TO DETECT COSMIC
UNITECTRONS OF EMERGY GREATER HAM A TAV
5. L Stephans (MASA/GSFC, Greenbeit, MO 20771), and
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km statelor lines are Poleutine, Taxes.

I tempty lines, Niue, Yeper JAIIJb

IND COMIC Tays

KLE EDMINION OF GALACTIF COGNIC PAYS 5:
ING-DEPENDENT MODILATION

J. E. Main (Space Science Ceneer, University of New Expairs. Durham, Re., 0)822) and L. A. Pies

Augustical satchalque is introduced for the solution of the Tire-dependent equation for the solution of the Tire-dependent equation for the solution whistopherical selleuse is squeezed. We litustrate this with a model too the solution-try heterature. In the solution of conterny heteratury. The westarten is assumed to savid from changes he the number of enhanced to facility acateting regions, which are produced by furgomested shock wases in the solar wind. The whole an amount for the observed solar-cycle unities in intensity at different moneyies as well at a control a supplemental of the coentral supplemental for the coentral splending furgomested sides. It could be the coentral supplemental for the coentral splending furgomested sides. It could be additional.

A Stylys, Ess., Sing., Yanay Vallis

4 Strybys. Res., Slua, Yapor 341319

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Eistick by Sect-Spike Ryents at Quasi-yeapembloulas

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Bort L Broker iApplied Physics Laboratory. The

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d. Scoplys. Res., Since, Paper 3AL210

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For Ing wave lengths, the lait-hend polarized onde to found to be stable for \$600 and the right-hand polasized mode for \$800 and the right-hand polasized mode occurs for \$600 and selections to late the lattice for \$800 and \$800

J. Couphys. Sea., Bius, Paper 1A1298

Particles and Fields-

350f tertibles and Yields - lescaphate (Airgins)
RADIATION TRANSPORT EFFECTS OF THE Of 1336 A LING
INTERNSTY PROSSILE IN THE DATEON
B.J. Strickland (Eases Angenistes, Loc., Fost diffts
Row 2395, Resten, Vinginia 2290), O.S. Anderson, Jr.
The 1350 A daysfow I fub intumity is malcalated for
a warlety of creditions. Contributions see Included
from both the OI 1356 A and 5, 188 1354 A features.
Photosimutron stollation sets are calsolated with a
acceptly descloped computer code by Strinkland and
Malus (1922). OI 1336 A multiple mentering smitting
approximation and are found to be as much as a feature
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approximation and are found to be as much as a feature
of i.O larges with the sectal value changing along the
profile. Multiple mentering ann, therefore, not be
liguoused is analyses dealing with 1354 A limb date.
Solutions are generated for four ente of conditions
defined in terms of solar activity and she modal
atmosphere. Setticashle variations occase at these
conditions see sitems. Excellent agreement is
obtained between the theoretical inioneStime and limb
date from the RMS-PM establish to yapontrometer
axystiment. (Photon teansport, dayslow, limb intonsities).

Strinkland, D.J. and S.O. Moiet, A Photosinetron Model for the Rapid Computation of discephario Excitation Exten, RRI Memorandum Reposs 5094, Detember, 1992. J. Caophyu. Ras., Blue, Favar JAI210

3503 Altgled CALCULATED AND OSSERVED LING PROFILES OF dl 13f6 4) CALCULATED AND OSSERVED thus PROVILES OF dilinis 4) DAYGLAY
A. L. Hawman, A. B. Christensen (Space Sciences isbotatory, The Assespace Corperession, S. d. Box 97937, toe
Angeles, Cefifornia, 90009) S. S. Anderzen (Saval
Reseach Laboratory, Weshington, B.C., 201f)
Limb-scan absessations of stosic oxygen di(135 A)
calcelose abtained with the D-messor eliteratolet spectroactes pachage flows as the Defense Metentological
Satellite Srogrem (BMSS) PA Estellite are analyzed with
a Tacamsiy developed resistive transfer model saing
best customs estimates for the excitation crossmentinus, branching estics, and photocalctron fluxes.
The topside scale haight of the limb profile depends
sainly on the exceptual temperature, Y., used in the
model computations and the pask intensity of the
estation profile depends on the stonic oxygen
density. To a lesses estem, the sittude of the pask
and the shape of the profile vary with both y, and
anyon density. It is above the not are then bell of the
estation oxiginates within 19 km of the tempent point
altitude along a 100 km sequent at the limb-oi-sight.
Comparison of calculated and observed profiles shows
good agreement ond euggents that Limb-scen obsessed shows
may define the sittlede distribution for some theroumpheric species better than semplitical models elone.
(Airgley, Limb-scen, oxygen, debeity).
J. Geophys, San., Sluz, Paper Mi20b

DOOR SITE OF THE PROPERTY OF THE PROPERTY AND RESPONSE AND INTERSITY AND ROYATIONAL TEMPSRATURE VARIATIONS DURING A 14-HOUR PRAIO AT 78 M.

18. K. Hyrabé (Norwegian Defance Research Catchlishment, 8-2007 Sjeller, Sorwayi, C. S. beahr and G. G. Sivjac (deephysical tastitute, University of history Alerbank, Alasha 99701)

Vs report cesuits from a continuous Sh hour measurment of the DH(8-1) hand extending in the nightglow at 70.4 M. In used temperature of 2578 and a sean band intensity of 590k were observed. Betreen temperature variations were sean with amplitudes up to 1.70. from the mean. It is suggested that these variations set related to the passage of internal gravity waves. If up, the chirchs suplitudes of the variations night imply that the OH ontring loyer is situated above 90 km at this latitude in Jacuary. The deduced in values falf/1/3/79) favot the ocons sachanism to be responsible for the Question with the possibility of an odditional sechanism contributing up to 55. 10% air-gled, latently, tempsrature, gravity Mavae).

J. Geophys. Res., Sius, Paper 140990

J. Geophye. Res., Elue, Faper LAON-0

3320 Ejectrle linide
SFEEAD F PLASMA EMBOLS VERTICAL SISE YELOCITIES
DEVSEMINED FROM SPACED (ONOSONDE OSSERVATIONS
N. A. Abdu (institute de Paquiesa Espaciala, Conseiba
Enciosal de Ossenvolvimento Cisnellico a Tacologico,
13290 São José des Campas, Op, Craill), S. T. de Medi
tos, J. H. A. Sobral sed J. A. Eletencourt
Systeonrit time difference in the omeats of apread y
scenta in the iomograms are observed between the magmaric equantarial starlon Fottsless (1993, dip
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publica (2994, 45°0, dip latitade 1982), two stations
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in Brasti, jorated at clase hi magnatic wacidons
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On the securption, justilied from diflacent exparimental abservations, text ha sprand P leragularities
occur in strongly linid aligned plason bubbles that
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equator, and ties up in warticelly sinagated rolumns
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vino differences in the means of specad P evente at
the two stations, to the please bubble wartical rise
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easaltic reabsiques, and further show, at times, good
coresistion with the supiltada al the presence pak
la the wartical drift reincittes and the heights al the
eroning equatoric F-layer. Fossible lapiteations al
these reveils see discussed. (Flesse bubble eclocity,
electric field, sprand F, lonesande).

J. Geophys, See., Slue, Peper Mii91

5330 Sigh-latituds ionospheric ourrents
COMPARISON OF HEIGHT-INTEGRATED CHRENT DENGITIES DEOLYDE FORM GROUND-RASED MAGNETOMETER
AND ROCKET-BORNE OBSERVATIONE DURING THE POCCUPINE PJ AND F4 FLIGHTS
Ch. Isoclieck, W. Beumjohann [MP] f. Extraterr. Physik, 0-80A0 Gorvhing, W-Germanyl,
K. Schlag, C. S. Cecioon and H. 1. Bush
The Porcupine FJ rocket was isunched doring
e period of low magnetospheric octivity while
the P4 rocket fiew dwring a rather disturbed
interval. Measored electron spectra wace weed
to calculate losespheric occeptotances waing
Rees' Rethod. Together wish plactro field
measwremmeate height-integrated ourrent deceities could be calculated from the rocket eaawremente. Height-integrated ourrent deceilties oben osiculated from ground-based magnetomaier date by means of field usperation ead
upward consinuation. A occoparison of the ourant deseties derlyed by the different methods
ahows excellent agreement in the quiet period
during the FJ filght while there are differances during etronger magnetospheric activity
(FA flight] due to different apatisi and tamperal resolution of rocket and ground observations. [Righ-latitude longspheric dwreads]
J. Comptys. Ses., Shie, Pager Mil64

fas mats sclive sanditions indicate a dignificant upsets flow of ionization during to mid-affernoon. Calculated wisciton temporalizes sets faund to be consistently lower than masseved temporations during the detries. Calculated values at N.F., and be agreed with masseved results except during the peat-midsight pested. Calculated values of the los flux ledicates 24 hour set flow of lonization from the northern to the southern hemlophete amounting to 10° and 6° of the equilibrium flux tube contest above 1000 km fas the solution of the longer transcription of the perturbation, respectivalt. Electron temporature, modaling, incaharant scatter, ion flowel, J. Caophys. Res., Blue, Paper 3hl 316

J. Ceophys. Res., Blue, Paper 3hl33f

3143 Ionompharic disturbances

INFLUENCE OF SOLAR SCUIDE BOUNDARIES ON ICHOSPHERIC

VARIABILITY

8. Hendilla (Astronomy Baparceant, Scaton Delvetelly, Boston, Massachusetta, d2213) and S. Schatten

A institudinal network of total sinetron content ITEC)

chastvations has been used to massas the contributions to day-to-day 7-segion worlability associated with a wide variet; of saint-tersectrial phenomana. Racean discussions of a proposed "sum-weather coupling" affect releted to solar which becedary (3D) crossings processed a systematic search to document any upper etmospheric componence of such a librage. This data from sceenal Horth Americas sites close to the 18th day Labrador (L. 4), Segunore Mill, Massachusetts (L. 3), and the Rannedy Space Canter, Sloride ft - 22 sere examined during the years 1913 to 1913. Asserged edylize (0900-1100 17) TIC values fore compassed with a 27-day mean tentaced on the day of an 85-crossing. The resultance percentage deviations were assained for second to BB-crossings. Asserged edulis for the entire Oata set these peak excursions will within the 18-18t deviations peak excursions will within the 18-18t deviation has particulas (t. 3-3), the TEC resistions had see ordered transition from cohenceants to depistions felicating an 88-crossing. As lower latitudes 11 - 21, the opposite pattern of depistions felicating an 88-crossing. As lower latitudes 11 - 21, the opposite pattern of depistions to enhanceants counter the well-known pattern of a tempeloin to on the receive and sector is crossed. A morging of those two results engages that the wall-known pattern of a tempeloin for one characterist the veil-known pattern of a tempeloin for one the sector of the average "geomagnotic" companies and of the sectors of the sectors of the consension that the samifestation in the P-roglon of 88-crossing is noth

periods.
J. dosphys. Reg., alus, Paper 3Alif5

If Gonephys. Res., Elus, Paper 3A117

If Jonnspheric disturbances

NOTION SIGN SINUSOIDAL INFEGULARITISS IN THE SQUATORIAL FREGION

C. S. Validares (Senter for Space Sciences, University of Yevas at Dellos, Richardson, Fl. 78039), W. S. Ramoon, J. P. Resiure and S. L. Cragin

A new category of equatorial F-region pismon irregularities having properties assily distinguished from those of pismon bubbles, deplations or broadband turbulence has been identified in the data from the Retarding Fotontial Analyses (874) and the low Ortic Merricolo on the histosphere Explorer satellites AF-C and -3. These irregularities are observed in the bettomatics at night in a narrow beit according approximately 112° from the displayment of the second of t

SST9 Total Electibe Content
MMDELING Phi TOTAL ELECTRON COWIGHT OBSERVATIONS ABOVE
ASSERNION SELAMO
D. S. Andeveon (4ir faice Gaophyaics Laboratory, Sanatom
All forca Base, Magsachwaatta 01731), 1.4. Simbucher
Rement larada; rotation (136 MSe) measurements heisend
facansian island (8°S. gang, Lai., 343°K geog. long.:
15°3 dip. lat.) and the 1880 saidlitte (aslouth of,
alevalion 80°) laveal two characteristic fantures
associated with the andisturbed, ambient ionacphare—
a inta afternoon decrease in TEC followed by a postcunsate chanacement which fasis for two to three houvethe thomatically investigate the ambient inemaphera
above Ascamsion laisend by numerically solving the timedependent plasse continuity squation, insuling the
affacts of ionization production by solar uitraviolat
radination, less through charge acchange and transpert
by diffactor, f. x & drlft, and neutral wind (both anna)
and enrichoral components) appropriate for an equinoctial, solar cycle smelmum period. Is is lound the
the post-summat enhancement in unpear dr x d drlft,
which is a charasseristic factors charged by the
disparace incoherant acater rador facility during
solar cycle actions pariods, is primarily responsible
for the post-sessi increase in fCC observations At
Ascension faland between 1900 and 2300 LT. The lata
aftersoon decrease in TCC is caused by as increase in
the podemard neutral wind velocity which lowers the
flayer into a higher loss risk signo. Inclusion of
the revidional vind not only reproduces the observed
decrease but size, noullates the post-sersei past. In
TEC os that it is in each better agraement with the
observed values. Calculated north-about Aspreachia,
and winde)
J. Ghophys. Res., Blue, Faper JA1106

5500 Mave propagation
SINULAID SCATTERING By COLLISIONAL MODES IN TRE
19M05PIRE
1. Stanfio (Department of Plasma Physici, Uned Universty, S-90)8T Used, Swedon)
1/8 polal gut that it ought in be possible to obseed
Rimerlated scattering by the bo-atrees Farley-Bineman
and the gradient-drift modes in the ionosphere with,
for example, the rader facilities in Roythage ScandiExvid. (Pisses, spoilinger, toilisions).

Ghophys. Res., Sius, Paper 3Ail06 .

A NUTTERSHIP DEPOSITION THE CONTENTION OF FIELD ALIGNED INFERGREATIVE BY A HIGH POWER RABID WATE T. 5. Jones (Constituent of Physical, University of Laiguester, Latenster Lel 785, U.S.), T. Schinson, Y. histobic and J. Kophs.

The demonstrate with the superprise of a high power radio save pathennia authoria and absorbed during count intemplete authority and results are consistent with the measure less that the growth of laid a lagod irregularization duty the the growth of laid allowed langed irregularization duty the latenses for a high power pump, wave and the latenses for a high power pump, wave and the locopharia planes occupie in the atessas. Dating the growth is the atessas Dating the initeability which has a threshold independent of arrival ion supplicate. When the africation level la

sufficiently high, the threshald of the escond erage is reached. The second stage threshald is dependent on the striction supplicude. The state of bedrground ionosphera is also lound to be as Exportant Lactor influencing she characted effects. (Modification, hystorenis, anomalous absorption).

Particles and Fields— Magnetosphere

STRS Bow shock waves

I NECHMISK FOR PLASMA WAVES AT THE BARNOWICS OF THE

ILASMA PERQUENCIL IN THE SICCIROS FORESHOES BOURDARS

J. It lass (BASA/GEIC, LeGeratery for Extraterrestriad

Papalos, Creschell, MB 201711

I homp-on-tail nestwice reduced relocity distribution

bus been constructed from date obtained at the upstress

bussdary of the electron foreshook by the CSSC electron

epactronaler experiment on the ISES-I actellite, This

distribution is seed at the Initial please state for a

nucerical integration of the 1-B Vissov-Manysil system

es equations. The integration is cerried through the

grawth of the instabifity, heycan its saturation, and

saff into the asiablond please isgine. A power spentrum

ior the electric field of the stabifized please is

computed. The spectrum is doclerted by a nerrow peah at

the Rohm-Grous frequency of the undestrived please is in

sharp peahs which are affit into cleasly spaned

daublete. The indementate pack at the Rohm-Grous

frequency. In this seas into a closely

epaced triplet. The epfitting is due to slow modu
latines of the stabilized sicsiric field acciffations

rich, it is thought, are caused by save-pasticle

ireplus. The wave length of the mith harmonic of the

Rohm-Grous frequency is given by 1, where i, is the

rave length of the ancishic mode. The eschedies for

reclistice of the accomb harmonic is above to be seamed

order wave-wave compling which takes pleas during that

peried is the avoiction of the freshelfity which would

atherwise he called the licer-growth passe. It is

conjectured that the higher herecaion are arcitud by the

sease acchamics. It is further asgued that harmonic

restability, hermonical.

J. Coophys. Ben., Sium, Yapar JA1103

J. Caophys. Reg., Sius. Yapar 341103

6720 interactions (Sois: Wind)
NOTHINEAR ELFECTS RELATED TO THE FORESHOCK
R. W. Jacison (Repartment of flatirical and Computer
Enginearing, University of Batsachusrits, Arhersi,
Assachusets, 6003)
Second order affacts are calculated for a low irequency electromagnetic instability due to an ion beam
in o plasma. This instability is a characteristic of
o paralial shoot model which includes an ion reflecting
elatrostatic sub-shock. The realysis is similar to
that done by S. P. Gary but a counterstreaming configeration is chasan which is horocomeous in time and
which has sparlatly growing modes. Among other effects, energy is tronsterred from the incoming main
plated inns to the team ions, flection pressure efferts are reliculated and are small for ion frequencies,
the application of this model to the earth's bow shoot
is discussed. (Quasilinear, spatially growing, low
frequency, locethock.)
J. Geophys. Year, Blue, Fapar latins

J. Geophys. Yes., Blue, Paper Jail 45

5745 Magnetospheric Configurations Low EMERGY PLASMA ION OBSERVATIONS IN SETURN'S MAG-

1745 Magnetospheric Configurations
174 Mirphy PLASMA ION COSCEMPATIONS IN SATURN'S PACTICOSPREYS.
Alan J. Lessrus and Relph L. Meibutt, Jr. Hepertront of Physics and Center for Space Passarts, M.I.T.,
Cattridge, M. 22139

We summarize observations of positive Ions in Saturn's magnetosphere made by the Voyager pleats science experiments during the two Saturn encounters. In the outer magnetosphere, the number density and temperature of the pleasa is quite variable. Men colf, two tonic spocies see Ctearly resolved: the inject on is probably H' and the heavier ion has a mass/charge ratio consistent with it being & or M'. In the vicinity of 18 Saturn eadil [Agl., there is a require in which the composition or charge state of the ions apparently changes, but it then returns to the typical composition. The two ionic conformats do not have the same thornal speeds or temperatures. In the outer magnetosphere, their arisethal speeds are approximately 7th being already in their arisethal speeds are approximately 7th being the composition. The two components partially co-rocate with the plant are still undetermined. The acutes of the plant crossings does to Stump of Saturn, O' is the dominant ion within it Ag iron the signet in the ring plane. The acute height are crossing the tring plant, whereas 6' dominates outside of that distinct from the ring plane.

The acute heights characterize the 0' ion subter dominated within the two acute heights characterize the 0' ion is two high to be consistent with each scale height: The coparature anisotropy of Taperfyll, approximately equal to 6 would explain the characterize. The cause of the independent plants and comparation anisotropy of Taperfyll, approximately equal to

in dynamical equilibrium. is comparted terms's mag-metosphere to Jupiter's, there expesse to be such loss acceleration of low energy planns to higher energies at

37Ji Hagnetic said CASTREAMING DIFLING SUBSTORMS A. T. Y. Lai (Applied Physics Laboratory/Johns Rephires delected by Lames!, Maryland 2010'), Y. E. Estuan, O. J. Villiams, L. A. Yeank
On the basis of three-dimensional measurements of mergacia particles and places from the 16EP-f aparecess; the occurrence of Son hasse at the yierse sheet boundary in the magnetocal previously respected by Williams (1981) is examined to relation so cehetors satirlay, to all seven cases studied it is found that ion hears attending catthward and/os tallward are slways yearsent at the sign of the places sheet adjacent to the tall line. Soo beams protrating into the places sheet regime with no detectable density gradient are also observed. The observed on beams may once at high songline of a son of key, or as medium copygies of a fue key, or was at secretae as led as tens of ey. Their lateosities and surgime of and the wagnitude of the vehacors caset and expension phases or the augnitude of the not have may dividual relationship to the wheatore command ampassion phases or the sagaitade of the subsumers distributes as indicated by the AR Index. Soweer too beams seed to be move lateres and extun st higher eatrests when the planes shert is entiglated during the substore recovery phase. The requision supposes that the activation of the secret for the streaming loss is been divided by sagaritation with any pasticular phase of a sahetore. (loo beams, sobstores)

J. Geophys. Kas., Slue, Papes 341270

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5755 Piesaa imatobilifinn ON THE ORIGIN DE PLAMMAIPHERFC XISI: RAY PATH INTEGRAIFS AMPLIFIFATION

S755 Pissas instabiliting
ON THE ORIGIN OF PLARMAPHERIC HISS: RAY PATH
INTEGRAIFS AMPLIFIFATION
S. R. finrch (Ponsidon Research, 1299 Ocean Avanua,
Santa Monica, Celifornia, 90401) and R. M. Thorne
A thorough lavasitgation has been made of processes
rempassible for the growth, damping and propagation
characteristicn of whistlar-mode estations within the
Earth's planmasphare. Three dicensional ray path talculations of the laiegrated wave pain in a realinth
model planmasphare hase provided on explicit contirmetion of the anisotropic efection cyclotton reasonal
generation mechanism for the maintenance of plasmaspharic hinn. Pack were explification occurs for
fiold stigned wavan in the outer plasmasphera. Inn
majority of wanteble low franged within the plasmapadus and one thus frapped within the planmapadus and one of internal reflection of the planmapadus and mageafonpharic reflection of the planmaphera and mageafonpharic reflection the high laftlude
provide an importent class of cava frajacinctes which
are recycled back to the equatorial growth vengion cith
auffitfanity small wave normal angles in allow further
cyclotron resonant amplification. It is unlikely that
when growth case occur from the naferial incoherent estisivity level wightle the plasmasphore nints the required gates (= 100 cb) wond mandain arreasonably
high prergetic electron flue. An aitarnata, an yei
unifertified, ambryonic aownce is therefore required
to initiate the growth process. But once actabilished
the observed apoctrue of bread band plasmaspharic hiancan be mainfalined by the modent nat goin anticipated
along ray irajacforini which ere recyted bact to the
fevorable aquatorial growth region. Animation of
the spectral propertine of cevas arriving at aeletted
observations cycled waves whith reflect from the pfasmapass
for mocycled waves whit pack gain in relativity logensities to the location of the observation point, and waven are expected to errive ownre broad solid magfe in temper consistent with observations. The shillty of waves in gain examn for regions far from the source in A direct result of the relativity weeker tenden desping of chilque waves slong the high fatigude portion of the recyclad ray path is comparison to the equatorial cyclotron resonant growth. J. Geophys. Rus., Blue, Paper 3ALISS

5761 Plancapeuss
RAME CRONNO-BASES OBSERVATIONS OF SIFIE VLF TRANSMITTE
SIGNAIS OUTSION THE PLANMAPACES
D. L. Corpecter (Spers, Teferomeunirscions and RaSinscience lab, Siesford University, Stealord, California,
94305), T. S. Milist
Signais from the Siple, Ameratica (L. -4.1) VLP
transmicter observed at the coolugate ground station
Roberval, Camada have previously hour fosed to propegate wither eithin the outer plasmappear as within the
region of stamp plasmappears dessity gradiests, but an
pathe clit equatorial electron density that is within
o fastor of 2 ol vearby plasmappearic levels. Ve report
hard tes cames in which propagation occurred jast outside the plasmapaces and at plasmatrough density levels.
in one rase a scales oil is palses and frequency tamps
was observed; many oil the pulses riggered risers with
slopes oi 10 Mis/s, such accepte than those assetiy
observed within the pfascesphere. In the other case, no
swidence of triggered esistions was seen on the Siple
pulsars, but instead officions ochasing occurred and noise
based procurrent to large vave bursts were initiated.
The wase bursts were of a type that has been previously
identified as driving iranslam hursts of a lectron precipitation into the locosphere. Soth cases occurred
under regnatic conditions mere disturbed than those typical of atrong Otpis signal propagation for the outer
plasmapphase. (VIF wave bajection asportments).
J. Geophys. Ros., Sive, Paper 1Ai109 J. Geophys. Ros., Siue, Paper 3Al 10

NISO Wove propagation
THE GRATIAL STRUCTURE OF STARE ARDAR RESULTS
W. Allan and E.M. Poultor (Physics and Engineering Laborator), DSTA, Lower Butt. New Sealand).
The TTARE raiser system has proved useful in estimating the forcephoric electric Helds of several types of the pulseion. These saustly thvolves the propagation of hydromemetic uses along the quemagnotic field lines. Beliection at the surroral inneaphers boundary can then result in standing wave issonances. Due to its good spetial resolution and coverage of this boundary, STANE provides unique data on the spatial variations of the pulseion fields. Background theoretical aspects and STANE observations are presented for three types of putaction; topulative or ringing Pcf's, nonconcreate resonant Pcf's, sof pulsotions isought to be generated by instabilities in the ring current perficie population. Since the ionosphere (a realistive, if acts as an energy eink for iss pulsations, and astinates of the ionospheric jould heating are presented. Finatly, sone suggestions for future work are given. (ULI pulse tions, atant radar.)

Physical Properties of Rocks

blic elasticity, fracture, and low Successifical CRACK GROFF AND OTHER TIME AND ENVISOREM OFFERDERS SERVICE to GRUSTAL FORES. P. t. Swanson (Cooperative institute for Research to Shwiromental Sciences, University of Colorado, Rouldar, Colorado Bolloy!

Brable stack gustrh strongly influences both the fracture strength of hittle rorks and some of the phenomene precursor; to catestrophic fallure, Quancification of the time and environment dependence of Fracture propagation to ottemptral with the one of a fracture mechanism technique, We examine most of the difficulties exception to ottemptral with the one of a fracture sechanism technique. We examine most of the difficulties uncontered when applying technique originally Society of the second and the second of the difficulties of the second of the difficulties uncontered when applying technique originately Society of the second of the difficulties uncontered when applying technique originate complex setories in loge disease of the second of the difficulties of the second of the second of the difficulties of the second of the diffi turo in teranica and (4) styloratory tasta axa-mining the time dependent reapones of rock to the application of water. (Outertical frac-ture, fracture merhooles, presons some, mirrosructure], . Gaophys. Res., Red, Paper 181075

Ails Staticity, I rocture, and floc
RAFS-OSPENDENT EXTENSIONAL REFORMATION RESULTING
PRON CRACK CROWTS IN ROCK
P. Segail (U.S. Geotogical Surray, Henio Park,
California, 94015)
Quest-match propagation and diletims of
bacroscopic mode i cracis is considered as a onerce
of incissific strain in crucial rocks undergoing
extoneouss deformations. The approach here is to
first rharacterive the propagation of a single
citicaling crack, and then to consider bow a large
cutomolousi array of cialtar, goraltat cracks
acconducted an applies deformation. The driving
force for armagation of each crack, Og, is found
as a function of the applied strain and the instantencouse tract lengths, E.: The rate of crack
propagation or the applied strain and the instantencouse tract lengths, E.: The rate of crack
propagation areas attantion force i. - (Eq.).
A sponific propagation-rate antennion-returns
tentament crack axiansion force i. - (Eq.).
A sponific propagation-rate antennion-returns
to a selection of the sponific returns
to a selection of the constitutive law
is derived relating uninefel acrass to the instantaseane unianist at cale and come department
is derived relating uninefel acrass to the instantaseane unianist at cale and come department
is derived relating uninefel acrass to the instantaseane unianist at cale and come department
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is derived relating uninefel acrass to the instantaseane unianist at cale and come department
is derived relating uninefel acrass
to the manual of the second of propagation, the average arrage may opportione to
the applied of the propagation of the applied of the
tangament of the second of the propagation of the propagation of the applied of the
tangament of the surray attract any opportion of the
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tangament of the surray of the surray

etress increases oserly logaritholosil; with increasing applied strain rate. The temponen to unloading depeads strongly on whether or not cracks heat. Whoselog that follows seeling of the cracks with mineral procipitates canass the rock to undergo a persenent nou-recoverable ettain. J. Geophys. Res., Red. Paper 381349

5110 Physical Aropertise of Fonts BLIP DEPARTIET AND SPATE VARIANT FROTTON LAWS A.L. Noise (Thenrolloria and Spolled Mechanian, Corusil University, Ithmon, New Yors ASSI:

University, Tibaca, New York ASSSI;

The dependence of the friction force as slip history is described by as experimentally antivated constitutives law where the friction force is dependent on silp rate and state variables. The sche variables are defined macroscopically by evolution equations for their rates of change in cares of their present rates as a test resimble is adequate, or prove that one is inadequate. Analysis of steady slip governed by a single sinte variable in a spring and (semilaten) affect predict oscillations at a cuttoni spring actiliness \$ - korft. The orbital sciffness korft is declarated activities by a simple formula at a state at the for h > korft sed unstable for \$ < \$ orft. Atabe cariable Stickion law may superficially appears as a simple stilp rate dependence, ally distinguate dependence, or tise dependenc static Stickion depending an experiment and instaing mechanism. The consequences of sieth restable Stickion laws can include crass waves and apparent take independence for some phenomena. (Friction, Scink-mip, Instability.)

J. Gembra. Eas. Red. Paper 3hills.

J. Geophys. Res., Fed, Paper 38121b

6119 Elasticity, Fracture, and Flow THE ROLE OF AQUEOUS FLUIDS IN THE INTERNAL FRIESION OF AULA.

J. R. Buleu, B. R. 11ftmana, M. Abdel-Sewad, and
C. Safvedo' (Materiala Charetterlaction Group, Rockwel)
Interwational Science Canter, Thousand Oatn, California
91360)

Interestional Ectence Center, Thousand Ostn, California 91360)

The affects of cater on alastic energy dissipation is root under upone crushal conditions one considered in this paper. Experimental ovidence indicaten that is dry rock the energy dissipation process lavolves water actional on the authors of very thin tasts. In Secondariam, the addorbed water in regarded as a vincualistic film. Portions of thin layer are forced to relaz as cruck thickness changes with the ponsing elastic when. A second ponable contentre involves the release from a lactic state of a lactic state with release from the supposing crust fata. When water in present as a buff full ottenuarion can be applained by the flow of a clacual filid into and out of very inin cruckn in ronposes in dynamic streams associated with a paraling ofastic when. Coophys. Res., Red, Paper 381350

Gl 10 Physical Properties of Rochs (Elasticity, freature, and floc) PROPERTIEO OF HIGS PROCESTY EFFECTS ELERASONTO PROPERTIEO OF HIGS PORGITT SANDSTONES Kanneth V. Winki er Schincharger-Doll Pessarch, P.O. Box 307, Sidgalisid, Connecticut Obd771
Compressional wave phrse velocity and actempation here here near essured in several high perceity f20-264) conditional es a montinuous function of fraquancy from 100 to 7000 him. Empire include Namelion, Berne, and Rolza seed sinnes and a synthatic Overd glass head sample. Both dry and brise esterated samples head samples of the results of the properties of

Planetology

B510 Atmospheres of planers
NITEGEN ESCAPS PRON MARS
J.L. Fox (Barvard-Smithsonian Cantar for Astrophysics,
dO Darden St., Cashridge, NA Olij8) and A. Delgarno
The senage rate of altrogen fone Mars is calculated
to be 2,5405 s⁻¹ for in a solar live conditions and
8.9x10⁵ s⁻¹ for high solar fam conditions. The major
sanres of sangaric atoms is dissociative recessingtion of ground sate, and yibrationally machted N\$
iona. The measured 'N*/NS isotops ratin can be reproduced by parentating an asrly deces areasphere
during which little differentiation occased. (Mars,
altrogen success, atmospheris avolution).
J. Buophys, Res., Shas, fames Nation. J. Doophya, Res., Stus. Faper 341204

b5f0 Atroaphares of Pianeta
SOME OSSERVATIONAL CRESTRAINIS DH THE GLOGAL-SCALE
afND STSIDES OF MARS
Rafph Xaha (Centar for Radiophynics and Space Research,
Cornell University, Ithaca, New York 148d1[
Vied direction oceannresenth from a veriaty of
indicature, Isken over annaral Mars years and covering
the entire plannt, have been collated. These inclinds
observations of las were clowed not pracionally
and associations of las were clowed not pracionally
and associations of the observations in turns of the
interpret most of the observations in turns of the
aonally symmetric circufation of Mars. We exomine
these dats in the context of the constraints the
observed wind directions place upon the thermal and
pSiar cap mans ffax flad's which force the flows.
Hithis the limitations of the dots set, aid and high
intifiade winds appear to be controlfed by the thermal
field during aid and late namer and winter, and in the
aorthere Seminphare, during early apring and early
number. At other times, the cap flows dominate. At
high fatitudes, the introgest yearly cinds are probably
generated by cap formation in the north, and Cap
recasion in the anoth. The hemispheric asymmetry
neems in reseit primarily from the affects of global
dunt aimms on the north palar tap. Larning of the
ptograde wind from palaward to equatorized is mid
actuals in observed, consistant with reducing pleasard
asins fice and increased meridional temperature gradient
at that thes. The latituding extent of the equalicial
Hodfay cefi, when observed, in probably larger than
that predicted by nearly inviacid podmin of low
intilinde circulation. The troes-equational Heaffay
cefi, and high latitude poleward from which occur in
both hemispheres daring the namer teadons, may set
odditional constraints on the thereal forcing
general tirculation.

J. Coophys. Res., Ster., Papor 3A110

659D Melsoritics
PMYSICAL PROFILES OF GROUNARY CHOMOSITES
Kiyoshi Yosopida (Geophysical Institute, University of
fotyo, fotyo 113, MAPA: now al Department of Earth,
Attenapherit, and Pianatory Sciences, Measschcaetts
Institute of Technology, Cambridge, Mata. 02139) sed
latafusi Maliusi
Physical properties (Intrinsit and busit
densities, porosity, compressional and shere wave
valocities, thermal diffusivity and conductivity) are
ensaured on alevan ordinary chondritus, one temboraceous
chondrits and two schondritic clasts of a se ansiderite.
With the previously reported results from Antertic
ordinary chondrites, the data are useful in clarifying
the diffusional temperature of a chondritus (-1800 kg/m3) is
gammagaily higher them that of t chondritus (-1800 kg/m3). The ample parosity, isse than 20 %, strongly
controls its efastit wave refortias, tharval
diffusivity med conductivity. The vectations of election
wave velocities and thermal properties with perofity
show that, as with lunse rocks, thondritus contain onny
cracts, these greats are thought to be created on their
parent bodies by the complation effect of many mutual
contributes. The difference between H and L chondrites.
Correlations between petrologic types, which roughly
adviced in a teributed to the content of metally (-P-81,
correlations between petrologic types, which roughly
appressed metamorphic temperature, and soropity styp lans
deprined to the content of metally (-P-81).

It appears that the aintering proteas for L chondriles La independent of the retamorphic events represented by patrologic type. {ordinory chandriles, cloatit and thermal properties, Consolidation]. J. Geophys. Bea., Ecd, Paper 301203

6575 Surfare of Planntn
SigrKGHN DF MINERAL ABSODPTION FEATURES IN TWE LEAVISMITTED FOMPOMENI DI REAB INFRARES SEFLECTED LIGHT:
FIRST RESULIS FROM PETAB.
C. M. Pisters (Department of Geofogica) Sciences,
Brown University, Providence, RI 02972)
Bidiractionel reflectance measurements are she only
type of reflectance data newlished to the remote obannyar. For compositioned interpretations data are
dimited not only for identification of possibile minmarei components but also for model abandance. The
latter requirem detaifed isformation shout the
latter requirem detaifed isformation shout the
ntrangth of absorption featurem. Using a new laboratory facility, the RELAG, laboratory dato in the
sear informed ore presented that downers olfacts of
particle size, minoral missurem, and viewing geometry
for aslected metariain with well download absorption
hands. The tomonaly observed increase is reflectance
with decrease is particle alse is also observed for
obsorption bands of maximum er/actance, however, a olsor
decrease in reflectance with a Generals a particle
nize is absectings observed. Small particles in parts as
the spectrum of maximum er/actance, however, a olsor
decrease in reflectance with a Generals a particle
nize is absectings observed. Small particles dominate
the observed Charatteristics of particles incompanies
the observed Charatteristics of particle nerfaces
which contain a runge of partitle sizes. The mean optical path length (transminsion through poeticias of
reflectad radiction measured for a variety of particle
niam has an apparent upper limit of shout 2 um for
particles <250 µs. fhs typical number of particles
lavolved is the optical post is less these 50.
(Num-IR reflectance, RELAG, mineraf absorption abouters)

J. Geophys. Rea., sed, Paper 3b1215

J. Geophys. Res., 2ed, Paper 361215

h515 Burince of Piecets (Mean Hovement, Mara]
THE GIYNPUO MONS MURCIE: PSEMATION BY GRAVITATIONAL
SPERADING
P. U. Francis (Luner and Pienotary Instituto, 1301 MASA
Road i, Mouston, Taxas 77010] and G. Wadge
Eav observatines of the aureols deposits of Olyopus
Mons are to agreement with provious suggestions that
the sursois lobes could have been formed by movement
ander gravity away frue the observed accept. The
characteristic cotrugated morphology of the sursois in
pushably secondary, formed by erosion along structural
inhomogeneties. Commercies of the corrugations and
remeistional faults to the sursois deposits lavor a
machanism of emplacement involving material with substantials of emplacement involving material with substantiance of the sepect racion of terrestrial iendacides, nappes and ashilows suggest that the sursois
depusits are more similar norphologically to stidecapiaced badies than to pysuclastic ficus. Atthough
marriso physical conditions parett the lormation of
ash flows, there is no positive evidence lot their
celstance.

celstance.
A gravitantae si spreading muchenism is proposed. A gravitational apraoding mechanism is proposed. Involving imbricate thrusting in disrel regions, assiopans with terrestrial rhrust sheers. Corrugations to the aurable developed by mroston slong imbricate or libric laufus. Basel shear stresses me the decoupling scriece may been shear of the order ol 10⁴ Fe [10 Aural. The nature of the decoupling aurfaces in the proximal regimes is uncertale, but is their to have been the topographic surface in distal perts. The sursols departs were pushably suplaced as a series of shoots by appreading under gravity from an encertail Olympus Home, which esteaded further to the north rest than does the present solcane, se a result of the secumulation of laves under the then praveiling stress condictons. Became isva supplies live the voicane have been concentrated in northeast and southwest seriors, indicating a changed stress regime since aureole waplacement. [Olympus Home, pravitation of apreading, stress statet. J. Geophya. Rom., Red. Paper 19117? J. Geophys. Ros., Rad. faper 381177

dSP9 General | Beturn Electropiatic bischarges] STALLBUICAL STUDY OF SATURN CLICTROSLATIC DISCHARGES

d599 Ganeral ISaturn Electrostatic bischarges |
STALISLICAL STUDY OF SAIURN CLICARDSIATIC DISCHARGIS
P. Zarka and B. M. PROGrams (LA CARS 124, Groupe Oscapstrique, Observatoire de Meudon, F-92175 Maudun Principal Edge., Francei During the Voyager-Saturn mission, the Planetary Radio Astronomy (PRA) e-periment observed eporadic broadband metasions (20 PMx to at 18e4 40 1841 during a law days around the Voyager I and 2 closest approaches to the classification of the vicinity of Saturn, we have made a statistical study of their characteristics from the toyager I and 2 high hated date of the PRA separiment (1-2 Mix to Ad.2 PMx). In this paper, we compare the results obtained for the two ancounters and describe in details the appearance, Intensit, and spectrum of the Saturn Floricatic Clackerges (SED). This spectrum has been lound to be appropriately flot in the frequency ronge 1-44 Mix No have determined the periodicity of the SEB-necurrents and its variation between voyager I and 2 accounters if 10009m for the V encounters and 10009m, services and 10009m for the V encounters and 10009m, services and 10009m, J. Geophys. Rem., Blus, Paper 3Al 170

Seismology

d920 Expinsion Bolemology
TRAVEL-TIME AMALYSIS OF BOREHOLE SKISMIC DATA
S.A. Staphen (Mood Role Gouonographic instituclom, Wonda Bola, MA, 021411, A.J. Harding,
10.A.H.T.P., Silver Straet, Curbridge, U.S.)
A method is presented for raducing travol-time
data from borehole selseic sappriments to valority-depth structure. The tuchnique, which tusers
aisultraneously dars iron any number of dopths in
the borehole in addition to serface data is based
on the linear Anversion scheme of Borman and
Jacobson (1981). Given the parameters \(\frac{7}{2} (\rightarrow - \frac{7}{2} (\rightarr normals facelyer. Zethetlon of velocities irom the inflection points of desper reviewer in-proves the rotolution of the velocity-depth func-tion which would be obtained from surface data since.

cion which would be obtained from surface data sinns.

The trainings is applied to data from three borshole salestic separtments in oceanir orust. The superients war useried out in the Westers Artenric (crustal age ~ilbm), the Gulf of Celtorula (travers age ~ilm) and the Costa Rica Rife are icrustal age 6 my. All three asperiments show resistively high upper crustal resocities (54.0 km/anc) suggesting that layer 7% to nor present swen in the rary young tust. All situs had over 100% of sediment thickness and it to postofeted that sediment chickness and sediment presenting the velocity of the upper cuset by sceniorating che oceantalies of fracteres and cracts.

J. Geophys. Sea., Red, Paper 28117h

d950 Reignic anorces
ACTIVE PAULTING AND TECTORYCE OF SURMA AND SURROUNDING
REGIOUS
A. T. he bain Lieboratotre de Odologia Structurole.
Deireralid dem Sclemess et Tachniques de Languados,
14050 Montpellioc, Prance), P. Tapponater end P. Moloar
This utory of the antire tactontes of Sucons and
acrounding restons fe based mostly on an inherpretation
of Lendest leegery and no faufc plane solutions for
shallow and totarmodists serthquakes. Pold aims is the
Indoburen ranges and so east disping inclined axos of
intermedicts depth methquakes suggest thet a sish of
occanic lithosphera was resconsiy subdected to the dent
ender the indoburen images. Facil plane beletimes of
shallas artiquakes, however, do mer show indecthrugging
at the prasent thes lusched, Paus art orighted
roughfy north-south, perallal, not perpendicufar, to che
fold axes in the ranges. Paus for fault plane
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d910 Saismic Sources

EASTHQUAKE FREQUENCY OLSIRIETION AND THE MEMBER T
PAILTING

8. O. Wesnowsky ilamont-Debarty Coolegiesi Chembro
of Coirebia Oniversity, Pailmedes, One Fure Helman
of Coirebia Oniversity, Pailmedes, One Fure Helman
The invet of intrapiota scinaity is fame puraity shows a positive correlation with the doming
Questornary Lauding. In southwest Separ, then turplate scinaicity is capanul rated on ind. They a
least anoment rologan 18. Jets stallar where cellulae
from nither the 400-year historical record of mice
ity or geologically dolarational allegates of decums
fecults. A data set of 16 conthquakes witheliae
monate (N₀| ramping Iron -G.01 to 3 in 102 for radius
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fault) the consent frequency distributed to the description
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y dater button in regional solamifulty sustees the
relative distribution of the sifp rates and impin y
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J. Omophyse, Ren., Red, Paper 136(92)

8950 Selanic Sources CHINA ORY ENGINEERS TENDER MAN MANN AND MANN A OCEANIC INTRAPLATE BENDING BABTEQUIES S.N. Wat d (Copertuane of Coologital Stiests, Lines Oniversity, Cashridge, Hessethnester, 021361
This paper develops a somet baser tenter technique suired for analysts of long perisibly wever from distanc, shellow earthquakes in silica-to the account tensor, the procedure resolver prom-source deprise (5) kay and earleares the deaths of levilting. The terhalque is applied to light SAO-QUUSSH rerordings al opter-rise, integio earthquates. These earthquakes recult from leeing of organic plates prior to subdustion. Infig oducus bartsootaf teaston sear the top of the ilthoughers and horizontal compresses much base. A neutral surface appearant confessioning resultant of steep being earthquakes to the pariod issuant, 1986 to Mi. 981 Indicates that the depth to the courtef estr the trunch-arc in the avoid fanery square of the and Fanegorff (979). In particular, courtel suffer at acrongly coupled Chilogy-type plats bening are elevated as such as it ha above those of such Coupled Harland-type boundaries. Thir correlat laption that negualfornities to seared suff compressive errors resulting from co piare-piate coupling. To account for the clind heights, saxbust interplate contraster state such be competable vich arrosses derived for beilly (Sody wave inversion, intropiate earthquirel.
J. Geophys. Rus., Pod. Paper 18/262

6950 Sethble Bustons the Geysers Georgewal arts.

1930 Setumic Sources
1930 Setumic Sources
1930 Setumicity in the Griser Grosseal are,
CALIPERNIA

0. Ebuchart-Philitips (U.S. Geological Outway, Inco.
at Sulsmology, 345 Middellinid Rd., 35-17, kmin
Park, CA 940251, and

0. H. Oppunisizer

A similar cous inversion for hyperanters,
velocities, and station delays was parformed from
the F-arrival times of 55 microsorthumias soft
osploateon distributed throughout 9.9-b 100-bs
region contered at The Geysert goothermia rat is
nurthern Calilousia. The mandiing one-decession
loyered model these value ity increasing with depth
from 3.4 hafe at the surface to 5.9 km/s at 5 m to
deeper. We relocated 7.215 oct throughes which
occurred between Kay 1975 and February 1982, sally
the new value ity model. These relocations show
oignificant opatial reloctoring near production will
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that the attems field that was est apparent is still
in the stems field that was est apparent is still
partern of melassicity chat the selescity at 55
telepura is induced by geothermal production
decivities. With the expansion of power production
by approximately 701 in 1979-85, smined activity
has Sevelaped mear the new production area.
Bolanicity has also appended cartherized at the
present production area, at though that ears es
active steam wolfs to this stam, butistical
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d970 Erructura of the crurt and upper mails
AM ANGMALOUS LOW THE COURTY MELICON ADVIT ME CENTERPHONARES IN THE JAPAN SOMEOTIAN ZUNTE.
APPENDARES IN THE JAPAN SOMEOTIAN JUNEAU AND APPENDARES IN A TENNAL TO A TENNAL THE PROPERTY MEANS HE APPENDARED TO A TENNAL THE PROPERTY MEANS AND A TENNAL THE APPENDARE AND A TENNAL THE long low velocity, subdiction form time !

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Equalised I(we profites using a standard rapered program, constructed a contour map of reduced tracing program, constructed a contour map of reduced tracing program, exceptions are well by recorded abordednt, investigation and seek wheely profite across the sales trough. Enables one tracined allow trough. Enables must be caused a section of the profite works in the camen a section of the profite works in the camen a section of the profite walls, a bacesome (by = 1.5 ha/s in legaled Valley, 3.9 km/s on the bordering messel, and a subbeautur (by = 7.2 km/s), and a subbeautur (by = 7.2 km/s). It is an abbeautur (by = 7.2 km/s). It is a subbeautur (by = 7.2 km/s). It is a subbeautur (by = 7.2 km/s). It is the horizon to 1.3 km (be. Haricon border). En the horizon to 1.3 km (be. Haricon border). En the horizon is a subbeautur to 1 km (be. Haricon laulites in thickness, can be bordering messe, however, there is a translating messe, however, there is a intentionity at the top of this mono.

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(c) The are apparently two cypes of bacconer. On the bordering messe, horeason is expectable trivial to 1 the chalacter from sedient to herecont criming, the low value of heavont relocity, and tested delegical and other geophysical considerations.

(d) Its abbessest, or intermediate crustal lever, reges in depth along the axts of the Salton reges from it the fisher seasof to 10 km (U.o.-

the subbassment, or intermediate ctmatal layer, tages in depth slong the auts of the Salten treigh from id he faiten Seal to 10 km (U.O.-Bericon berder). Cravicy modelling requites that this layer despen and/or pinth out between the this layer deepen analor plane out consect the bedring passe and countain ranges. Based on its high relocity and the presence of incrusive bruits rocks in the endinentary section in the layers) Vriley, the subbaracent is Cheught to be a wile character complex similar to occanic

Social Sciences

Name of Nominee

Parsonel Dete on Nominee

Oale and Place of Birth.

Susiness Addreas (including position held)

Education (degrees, tosillullons, major field)

Professional Record (including epecial honors).

Membership in Other Scientific Organizations.

hal have not yet been accepted for public

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THE SECONDICAL STREET BEPLETION MITH INTERDEPENDENT NON-LODGE AND REMPARAGE RESOURCES STREET BY A STREET S ments, grandwater from a near-recharging neutifur, with it used as an input in the production of a non-terralls and a renewable resource, potroisum and territis and a renovable resource, potroisum and spirature crope is explained and analyzed. The model is desired wing a finear afforestom porsector, non-fless set inactions see optimic control techniques, badts and discussed and interpreted with suppliate as

HE CONDUCT OF TRRICATION WITH NON-UNIPORM Informacy J. Leisy and R. J. Vaus, Jr. (Opportuent of fell and Invironmental Sciences, University of differits, Riveraide, Californies, P2521) Example Enjietricos on non-eniform water infiltra-tive in Irrigated Italia can be sessed with a

Economics, URC 35, Useh State University, togan, Useh, 84822]
This paper nzecines the short-run affects apportunity of an input. The measure of an increase in the variability of an input. The measure of an increase in the variability of an input. The measure of an increase in the variability la ine "mean preserving apread" suggested by Rothenhild and Stiglitz. The variables essented are real income (utifity), expected profits, capacited output, the quantity mead of the vontroitable input, and the shedow price of the atocheatic input. Four atriking features of the results are searly absorbed that have been really a decreased that have been really a meaning of the results are searly absorbed when an input is atocheantic; 12(ment of the signs of the partial derivatives depend upon more than concavity of the stiffity and production functions; (3) if the utiffity function is out "too" rist average, sign the rist-neutral results hold for the rist-aversion cases and [4] if the production function is Cobb-Songian, the deficient in the rist average in the rist average. The neutral results are achieved if the stilling function in linear or if the "degree of rist sweeters," (a really function in linear or if the "degree of rist sweeters, and present the rist of the rist of the results are achieved if the section of the sweeters are in a section of the sweeters.

Nominations for 1984 AGU Fellows Nominetions for Fellowship in the Union are being aought by the Fellows Committee

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heture of your acquaintence with the nominee; (2) the nominee's contributions to the

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For", aummerizing why the nominee should be elected a Fellow.

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of Fellows slected each year cannot exceed 0.1% of the total membership.

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economic optimization model through a comp-water production function. The edicate of non-uniformity are derived using two production functions which differ in torus of the satestivity of yield to applications all water areas or then that meeded to achieve anximum viold. Whether crop yield is sensitive to occase anter, productivil and optimal levels of water application are lower in non-uniform listed than in uniform Italia. Il crop yield is not sensitive to excess water, outcomes adapted as the price of water relative to crop income mat of water costs. The renductions, then, depend crucially or its inge of the production function. An example is used to demonstrate that Irrigation rechanicy and management which increases the unifossity of inlittration may increase both productivil; and the levels of regrecultural enter use, (Economica, irrigation, non-uniforeif). ator Besour. Res., Paper 34(19)

7310 Economica
TRE EFFECIS OF A CHANSE IN THE VARIABILITY OF FRRIGALION MATER Kannoth S. Lyon (Dapartment of Economica, UKC 35, Utah State University, Logan, Utah, 8482)

1310 Economics
CATECOST-UNITY LOSS FUSCTIONS FOR FLOOR PORECASYREGORGES BYSTEM EVALUATION
S. Krayascolowics [Sigatess Engineering Copetinent,
Dolvershty of Virginie, Charictissville, Firginia,
22901) and D. R. Bavis
Leonomic evaluation of the pariormence of a lond
lorscest-response system requires a large smount of
information for the satination of a loss function.
This fascrion must seemed the coase of protective
notion undestaken in tempones to flood warnings and
the licod denses sunstand. The concept of resporyuntr functions is exploited to reduce limit durvey
demands and to circumver high comporation requirenents. The loss function consists of a unit dumago
function, a unit cost function, and a unit teduriton
function; the dagge of response ther can be actually
implemented is bounded by a decision constraint
function. These low functions are estimated from data
of various origins low seven caregories of structures
and three caregories of decision unters.

Veter Resour, Fos., Fapar JV[19]

7310 Economics
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MARKET SIGNIATIONS YOU IRRIGATION WATER SIGNIE: S
MARKET SIGNIATIONS YOU IRRIGATION WATER SIGNIE: S
MYDDRAWICAL CAME STODY
Omescict O.G. Song and J. Wayiand Eheat i Ospartment ol
Civil Engineering, University of Illinois also in
the afticiancy of tee machatchin water rights grateme
is a leatin (ind-sile) atructure is assessed
quantitatively for a case study based on hypothetical
irrigation water one. Water rights unrively are
simulated no the hamse of it the acpected values of
water rights to the users, and 21 perfect forwaight on
the parts of users, and the recember are compared to these
agreement from. The market outcomes are compared to the
optimal infilience) achouse and to two siternative
normarket poiries. Bistributions in opsect of the
markets are arealized on the heats of individual lagoff.
Sisulation results show that higher afficiency is
obtained lor ise ton market systems these for the
conmarker poliries and that the market systems these for the
commarker poliries and that the market systems the optimal
distribution. The results engages that meet of the 54
affictency insu should be attributed to the design oil
the market system itself (i.e., the restrictions
imposed by the definition of the rights and/or abe
water rights all matter in pointy), rather thus the users'
laablifty to pradict lature svents. (Harkate,
assolution, rater rights).

Solar Physics, Astrophysics, and Astronomy

1110 Corona
COMDUCTIVE DAMPING OF CORONAL MOTIONS
S. T. Buess (MOAA/SEL/SEL, 121 Sussiding, Boulder, CO. 8000)
Time-dependent motions in the solar corona are subject to undification through conductive transport of theresis innergy sway lrow compression regions and into rerefaction regions. The avolution depends on have the energy fs introduced - by an assumitally theresi parturbation, or hy a density parturbation, the net effect of theresi conduction is to convert local Sinstic energy to the transfers into widely Sistribured thoras acargy, which then may in torn be partially converted into kinetic energy of the bulk flow, Local worked into the transient is thereby desped. These affects are modeled here using a numerical sofution of the tian-dependent solar vind equations for single-fluid, thereasily roductive liow. The simulations of transient phenomena are made for ordinary collisions; thereatily conductive liow. The simulations done using a simulations done using polytropic flow, Sotusco one and simulations dose using polytropic flow, Botwaso one and fire soier radii, the grass character in the two cases is very similar. Sowever, there are effects with thoras conduction that casnot be modeled with polytropic lieu, il justiced hore by tamperature and solution of the conduction of the conduct velocity forerunners and a delayed and large pupilitude trailing relocity low. If thermal conduction is artificially imbilited by stupie todaytion of the thermal conduction coefficient, relative velocity suplitudes reasin larger in approximata proportion to the amount the coefficient is reduced. [Soler corone,

7710 Corona (Helicapheric Current Sheet)
COMPARISON OF HERICAPHERIC CURRENT SHEET STRUCTURE
CHRANGE FROM POTENTIAL PROCESSOR FREED COMPUTATIONS
AND FROM COSEMUED FOLANIZATION COMPANIL BRIGHTEES
John N. Millow (Institute for Plasma Resourch,
Stanford University, Stanford, California, 943051,
and A. J. Randausson.
We compare the structure of the holicaphoric current
shoat early in Suspect Cycle 21 as computed iron the
observed protospharic magnetic field with a potastical
field approximation, and as inferred from synoptic maps
of the deserved coronal polaria tune brightness. On
most of the solar rotations compared the sourcetods
give essentially the same results; the basic shape of
the surped current sheet and the amplitude (in solar
latitude) of the displacements of the sheet from the
solar equator are similar. On one rotation the current
sheet computed with the potential field approximation
appears to be distorted by a large photospharic regime
of unfair-axis measure. New Sect. 1970.

Sheet). J. Geophys. Res., Blue, Paper 141053

7720 Electromagnetic radiation MEASUREMENTS OF THE SOLAR FLUX AT 220 nm F. A. Hanser (Panametrics, Inc., Walthem Massachusetts 02254) and B. Seliers The solar flus at 220 ± 8 nm has been measured from a halloon near 40 km in September of 1975, 1975, and 1977. The are rage value of the unaftenuated flux corrected to 1 A.U. La 4.43 a 1912 photons/(cm²-s-km), for oner solar minimum by as much as 25% over a soler sun This conclusion is strongly dependent on a few polote and is not incomment with a variation below 10%. (Soint UV thus, solar revisions.)

7110 Flages (Soier Ervadiance) SOLAR IMPADIANCE FARIATIONS, 17, AMALYSIS OF THE EXTREME ULTRAVIOLET MEASUREMENTS ON SOARD THE AE-R.

EXTERED ULVARVIOLE MEASUREMENTS ON BOAID THE AN-E SATELLITE
L Deter (Setional Science, Unabhageon, D. C. 20550)
Five of the attreme ofcraviolat channels (in. 15. Be i. Be II. Ye IV) measuring irredience llactuations on beard the AN-E satellite between 1977 and 1550 bewe here studied in detail. It is shown that the deily reviections to crespond sery rises by the deily variations in nofar ratio entials. It is shown that the deily reviections to no far ratio entials. It is shown that the deily reviections to respond sery rises and on date wereoughtened to the selection of the instruments. Is order to retreet for these changes, a statistical samiges in actrice ont, and a set of corrections to the raw date is suggested the chan mospers the resoluting, now uniform, date with rocket smarteness (is) and date acquired on board the AN-O sersilite (ip). Finally, re Siscuss the reselving discrepancies. After concluding that they are below the oversil level of uncertainties, as propose a lirst-order 10-year run of ENV irrediances derived from FIO.7 date. This methant includes the catio of irrediance in the following states and and 24 and the loterworing sholess. 200-r trediance. 207, anterior measurements. 710.7, solar settre regions). J. Gaophym. Res., Stee, Paper 141207

Tectonophysics

8110 Comenction corrects
HINTHAL UPPES MANILE TEMPSEATURE VARIATIONS CONSISTENT
WITH OBSESVED MEAT PLOW AND FLATE VELOCITIES.
H. Kaula FEat's and Space Salences Department,
University of California, Los Angelsa, California,

interests of California, Les Angalas, Catifornia, p0024]
The messactor sensitions applied to 3" htook sname are integrated from ian observed surface place velocities denoted to a depth of 780 he, sessating no insteal independent is in density or vigcosity. It is assumed that 35 partent; of the global heat preduction, Q = 0,85 a 4,0 a 10.1 My, comes from beins 250 hm; and that at this lares! the tenserac is fully convection. A temperature field 7 is inferred at depth 250 he by sintensity that the state of the field convection. A temperature field 7 is inferred at depth 250 he by sintensity that state are over the ophers, pis size ity, of the heat paperity, v is really resolving, in a presenting from 3,0 to 15 are tried. The intervening resonance fields are then inferred lategrating the energy equaried decreased asing the presidently californial that the integration is ambject to the limitations that the derivative of the toperature wish respect to depth is specialized afficient to attain the fully-convecting temperature, but never less than ediblects. A solface heat flow heat on observations which repair to depth in the section of the priceipal inferences and 1.1) the greatest team of the priceipal inferences and 1.1) the greatest team of the priceipal inferences and 1.1) the greatest departure of the property of this previous within the top 20 hm; (3) helms 50 km; the grature departure of pempirature from the sense or angulative "compose," reaching an extraord heat trainfar becomes

tore convective that conductive; (5) at the fully converting (avail 250 to, temperature variations are at least 2 100°C about the mosm.
The principal defect in the entire calculation is unrealistically low respectatives arising from unrepresentatively low surface heat flows. The principal defect of the model probably arises from the assumption that all heat transfer at a depth of 280 hm to repro-

di30 [Plate rectorice]
THE AMERICA-ANTANCTIC RiDGE
1. A. Lawver iPopertunt of Easth and Picanalary
Sciences, Mananchanasta Incellute of Technology,
Cochridge, Meas., 03119] and H. J. B. Dick (Moods Male
Oceanographic Instituction, Moods Noie, Meas., 03241)
The America-Antarctic Ridge was surveyed and dradged
hothern the Conred Fracture Zone at 50°S, 4°H and a
opmoding center at 60°S, 16,5°S. Five transform
levits and olx apreading center as general were identified south of the Coursed Fracture Zone. The speading
Self-race on the ridge meas runs Sourer triple junction

frad south of the fourad Practure Zone. The spraading Sail-race on the ridge near the Souver triple junction was lound to be Sunyaser. The America-Antarctic Ridge has great relief which is characteristic of slow-spreading ridges, As at other slow-spreading ridges, drodging of the iracture tomes recovered dishese, groenatoon, gobbro, and abundant peridottes fin addition to pillow health; trocks which are rare from last-spreading ridges.

Be the hasts of the new bothyretric and magnetic date, we save rovised rim pole of rotation for the American-America sed South American plates. Depending on the actual instantaneous pinte welcricies for the American-America Ridge at the Bowet cripic junction, the newly determined Antarctic Tooth Erwice pole of rotation is other tables. If the fall-spreading reas on the American-America Ridge to 9.2 maybear, or is 04,79 at 11 the rate is 9.0 maybear.

0159 Plake hemioning imprending omstern) 07EMLAFFING SETT 20NES ST THS 5.3°S OFFSET OF THE EAST

Oligi Plate helining [spreading ogstara]
OTHINFING EFT SOMES AT THE 5.5°S OFFET OF THE EAST
PAIRIC SINE
P. Lonedals (Marine Physical Laboratory of the Sorippo
Leatituling of Commengraphy, to Joila, CA 92051)
A Seabase and sagmatometer survey of the PacificaMasse plate boundary around 5.5°E suppos a "nontransform of Fast' when a geology and kinematics agen
typical of a whole class of structure formed where
Yasi-spreading rimes are laterally offest for distances
is as then the cidth of a subaxial sagma obseber.
Though its spreading menter is abroptly displaced by 15
is right-interally abers is no trace of atribe-ally
fivalling. lanteed the spda of two 100 km-long sizal
volumnin ridges war 15° toward anch other and overlap
for more than 20 km. In this overtapping region
beisson 5°22'S and 5°11'S, accretion of the upper nonanim offest by dise tajantion and cruptime is pertitioned betone two adjuscent and parallel rity zones
with obligan and ons-atted spreading. A continuous but
dog-legged spams obseber is inferred to underlis both
rift sones and an intervaling Pix-wide colleano-cludded
besin. A strong cagnatio signsture from the survey
which accraind around this oblique chamber identifits
the past 0.5 x 10° yours the southern stall ridge has
propagated north at bo me/pr, 555 ol ise spreading
all-rate.

1. Seephys. Res., Red, Papor 181254

Side Flate Tertonics
ON THE EVOLUTION OF MANDICAL BASIES
5. Taylor is available institute of Goophystes,
Oonotolus Sevel; 560211 and 5. O. Marner
Observed characturfatics of back are busins
invide; fil limiter processes of crustal
accration to major ocean basine. (2) Are treach
spatwas without carrently apreeding bach are
busines are in the major (1), 13) Although patrographically similar to and within the compositional range of aid ocean ridge basaits 18031;
bach are havin busaits 18882; show could lear
geochemical differences from F-rpp MOSS, and are
in many respects translational towards Island are
tholeitem (1ATI. (A) Oistinet SASE and IA)
mantle sources may be in extremely close proximicy during the initial rifring oil an Island are.
(5) Silring oil the wolveste are may occur on
either side oil the line of activa volcanoes 1:10
ban, and may vary irren one side to the other
along wirks. (5) A rammant are is not always
developed. [1] sheck are appreading may be intiated shows subducted lithosphere, but with time
the center oi appeading migrates away iron the
are and no longer overlies a Seuleif zone. [di
There is no simple correlaction between the riming
of global plate reorganizations and cha fonsation
oil back are basies.

The three wats classes of models proposed to
applain bach are hasin formation are mantis disptrius, induced assthanospheric coanaction and
global plate trenscales. Escanac the diving esthenian nosels Isli to explain the temporal and
spatial dastribution of bach are beston. The
third class oil models propose that hack are haalus should lorn whomecac global place lateractions require directing of several hach are
haims subgeste that the top and applicate the example,
suswer the tartoofc enerting of several hach are
haims suggeste that they represent one than
jout a paaswar appones do klaematic houndary
conditions. For sample, some dynamic back are
haims suggeste that they represent one than
jout a paaswar response of subduction, but they
are successive to mane the sew Hebri

GITO Structure of the filhosphere UNSIABLE EXTENSION OF LITHOSPHERE: A METSANICAL MODEL FOR BASES AND RANGE STRUCTURE R.C. Fistcher (Caster for Tectunophynica, Texas ASH University, Colfage Stetion, 18 77843(and 8. Mailat To invantigate the behasion of the inthorphere undergoing estassion, we uns a simple rhoofogical model broadly consists at with experiometal data on rock treep and with the saker of the brittle duttils transition. A plastic surface layer ownfiles a Substrate that deforms by power-law croep with a stress exponent n = 3 and an affective viscosity that decreases with depth. In astession this model shows a strong mecking fentability, provided the themai gradient is sufficiently large; Sthermise, alsafe uniform matension la indicated. The predicted structures display uniformly spaced mecks or regions of substantial production (basias) sitzmating with regions at raduced estassion (basias) sitzmating with regions at raduced estassion (assias) sitzmating if the depth to the brittle/ductile transition is roughly to ba, at suggested by the waximum depth of salamic faulting, the model yields spacings for the incipient basin-moderage at rectures of shoot 25-60 km, is excelled a spacenge with observation. lervatica. Gaophya, Kas., Red. Paper 180909

BITO Chrecture of the Lithoughare (Mionbrion) (
RECTRICAL COMMONISTY AND FURBLES IN THE LOWER UNING
T. J. Beachland (Geophysica Group, Los Linear Stituse) Laboratory; Los Limens, SH. 57545), and M. E. Ander
En have encylide both laboratory and vocileties riaff
date on algeriand conductivity to help understand she
physical implications of drup created a data ricely profaise. Beginnal hase flow cas cound to master temperatures to each layer in regional alse trial conducticity
modyfa; ca avoided those data where purely encodedivathent. How suggested temperatures more than showk
1000°C; ambetantisty higher than motions temperatures
and created the range of validity of bonh flom ondain.
The resulting plots of log conductivity or 2 1/T
demonstrate that even low conductivity layers [EGLa]
have operativities aboratory encoded that the date can be
represented by atwanget-line fits. In addition,
increasingly setter regions after symbositylly higher
conductivities than do shield areas. Become veightles
are usualty, let in laboratory means means with their